

Municipal Code
Enforcement Officers
Training and Certification
Manual



**Subsurface Wastewater Disposal
In Maine**

Executive Department ~ State Planning Office
2003

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**HANDBOOK
OF
SUBSURFACE
WASTEWATER
DISPOSAL
in MAINE**

**Soil and Site Evaluation,
Disposal System Design and Construction,
Administration, Permitting, Inspection
and Maintenance**

**For Municipal Code Enforcement Officer
Training and Certification**

Albert Frick and David Rocque

March 1997 (Fourth Edition)

Reprinted December 1998

Reprinted January 2000

Reprinted July 2002

Revised May 2003

HANDBOOK OF SUBSURFACE WASTEWATER DISPOSAL IN MAINE

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March 1997
Reprinted December 1998
Reprinted January 2000
Reprinted July 2002
Revised June 2003

ACKNOWLEDGEMENTS

The authors wish to acknowledge the efforts of *Daniel Soule* formally of the Maine State Planning Office for his administration and guidance of this Handbook; without Dan's vision, this publication would not exist.

We are very thankful to *Noel Dunn* for her help in preparation of the final manuscript. Noel spent many hours typing this Handbook and making numerous editorial revisions and we appreciate her endless patience. Also many thanks to *Linda Laplante* for her time spent converting this document to a web accessible format.

Randy Tunks of Maine Audio Visual Services provided assistance with photographs.

We received technical suggestions on how to improve this Handbook from *Jay Hardcastle* of the State of Maine, Department of Human Services, Division of Health Engineering, Subsurface Wastewater Disposal Program. *James Logan* and *Matthew Logan* provided additional technical advice and assisted with technical graphics.

Jonathan Champagne, Local Plumbing Inspector, assisted in valuable field demonstration of field inspection techniques. *Fred Kinney* of SEPTI-VAC, excavating contractor, assisted in field demonstration of construction techniques, provident his crew of *Chris Bernard Harold* and *Burrington, Jr.*

Also, *James* and *Jason Elder* of M.L. ROGERS, Inc. assisted in demonstrating field construction. We are thankful for their help and patience in putting up with camera crews.

The authors are very thankful for the patience of their families during the many hours they spent working on this publication away from home life.

This 2003 edition is based on a combination of updates to the Division of Health Engineering's Site Evaluator's manual, changes in Maine State Law, and comments received from *Russell Martin* from DHE.

The authors welcome comments and suggestions from readers on how to improve or expand upon this Handbook in the future. Please send written comments to:

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INTRODUCTION

Subsurface wastewater disposal systems are used throughout the State of Maine in increasing numbers to treat and dispose of domestic and commercial wastewater. Maine, primarily a rural and agricultural state, relies largely upon small subsurface wastewater disposal systems. Public sewer systems often are uneconomical, unfeasible, or unavailable.

Soil percolation tests were utilized in Maine prior to 1974 to determine the suitability of soil and the appropriate design of disposal systems. The **Department of Human Services, Division of Health Engineering**, which is responsible for administering and enforcing the **State of Maine Subsurface Disposal Rules**, experienced significant problems with this method of determining soil suitability and septic system sizing. An unacceptable rate of malfunctioning disposal systems resulted, along with associated health hazards, nuisances and environmental degradation.

The concept of site evaluation for disposal system design began in Maine in the early 1970's as an improved and more reliable method for determining soil suitability and septic system design. Rules requiring on-site soil evaluations for design of all subsurface disposal systems became effective in July 1974. They were significantly revised in May 1995.

Subsurface wastewater disposal design combines on-site soil evaluation, consideration of site features, and knowledge of engineering techniques resulting in a properly functioning system that will not allow harmful pollutants to accumulate to dangerous levels in the environment. Site evaluation requires a unique combination of knowledge of soil science, geology, and engineering. Licensed Site Evaluators are required to have the skill and ability to identify and accurately report soil textures and limiting factors so they can properly classify soils, determine soil suitability and the appropriate size of disposal systems. They must then use their knowledge of engineering techniques to design subsurface wastewater disposal systems to fit each unique site and specific applicant requirements.

Maine requires that individuals who design disposal systems be licensed. The **Department of Human Services, Division of Health Engineering**, administers the licensing of these individuals. A person who is interested in becoming a **Site Evaluator** must have an educational background and experience that indicates he or she has knowledge of soils and subsurface disposal design. Qualified individuals are permitted to take a written examination to prove they have the necessary skills and knowledge to design subsurface wastewater disposal systems correctly. A person who successfully completes the written examination is permitted to take a field examination to illustrate his or her proficiency in soil profile description. Only after successfully completing the field examination will a person become a licensed Site Evaluator.

Maine also requires that **Local Plumbing Inspectors**, who permit and inspect the installation of subsurface wastewater disposal systems, be certified. A person who is interested in becoming a certified Local Plumbing Inspector must pass written examinations on their knowledge about the State of Maine Subsurface Wastewater Disposal Rules, the State of Maine Internal Plumbing Rules, and Legal Issues and Enforcement Techniques. A municipality will appoint a certified Local Plumbing Inspector to permit and inspect systems installed to the standards of those Rules.

The **Maine State Planning Office** provides training in **Subsurface Wastewater Disposal Rules** as well as Internal Plumbing and Legal Issues and Enforcement Techniques and administers the Certification Program for Local Plumbing Inspectors. The **Division of Health Engineering**, promulgates and interprets the **Subsurface Wastewater Disposal Rules**, review applications for variances and administers permits for installation of disposal systems through the Local Plumbing Inspector Program.

Maine **does not** require **Disposal System Contractors** to be licensed. However, there is a voluntary contractor certification process through the Department of Environmental Protection, Land and Water Bureau and the Division of Health Engineering. Any individual installing disposal systems should be knowledgeable about the State of Maine Subsurface Wastewater Disposal Rules and proper construction practices of the industry. The First Edition of the Handbook was written in 1979 by Albert Frick, and was primarily a basic handbook for the practice of Site Evaluation in Maine for subsurface wastewater disposal design. The Second Edition of this handbook was written in 1983 by Albert Frick and was an expanded and refined version of the previous handbook. The Third Edition expanded beyond the basics of site evaluation practice to include practices and methods of Local Plumbing Inspector administration and inspection and basic practices of disposal system construction and maintenance. Albert Frick and David Rocque collaborated in writing the Third Edition.

The Fourth Edition continued the collaboration of Albert Frick and Dave Rocque in a revision prompted by changes in Rules and practices. The Fourth Edition also was proposed for use by the State Planning Office, Code Enforcement Officer Training and Certification Program. Chapters IV and V were expanded with additional details on administrative, inspection and subsurface wastewater disposal system installation techniques. A major effort was made to expand the graphics in these sections. In the years since the Fourth Edition was published, minor changes have been made to the manual to keep it up to date. Thanks go to Russell Martin at the Division of Health Engineering for his review of this document.

HOW TO USE THIS HANDBOOK

This handbook is presented as a training guide for individuals interested in Site Evaluation; Subsurface Wastewater Disposal System Design, Construction and Inspection. This handbook was written as a basic guide for a diverse group of potential readers (e.g. **site evaluators, local plumbing inspectors, planning board members, contractors, real estate brokers, property owners, and others** concerned with on-site subsurface wastewater disposal in Maine).

Chapter I	outlines the basic components of a subsurface wastewater disposal system and describes their function and utilization.
Chapter II	summarizes the important considerations of site evaluation .
Chapter III	discusses the basic principles of soil evaluation .
Chapter IV	concentrates on administration and inspection , including the proper methods for completing the application and inspection of systems.
Chapter V	addresses subsurface wastewater disposal system installation and construction techniques.
Chapter VI	describes home owner's maintenance
Chapter VII	includes special problems and other considerations in more detail, perhaps for the more advanced reader.

This handbook is intended to be supplementary to the State of Maine Subsurface Wastewater Disposal Rules. A person interested in Site Evaluation should seek training and education in basic soils classification, morphology, and subsurface disposal system design; as well as accompany a Licensed Site Evaluator during field work to gain valuable experience. A person interested in administration and inspection should accompany a Local Plumbing Inspector on field inspections. A person interested in disposal System Construction should work with a qualified installer to gain valuable construction experience. There is no substitute for *hands-on* field experience.

Anyone interested in becoming a **Licensed Site Evaluator, Certified Local Plumbing Inspector, or Disposal System Contractor** should become familiar with the **State of Maine Subsurface Wastewater Disposal Rules** and pertinent Sections of this handbook.

The **Local Plumbing Inspector (LPI)** will be most interested in Chapters I, IV, and portions of Chapters V and VII. Chapters II and III will be of some interest to the Local Plumbing Inspector to provide insight into subject areas of the Site Evaluator. The **Site Evaluator** will be most interested in Chapters I, II, III, and portions of Chapter VII. The **Disposal System Contractor** would be most interested in Chapters I, V, and portions of Chapter VII.

I. SUBSURFACE DISPOSAL DESIGN

SYNOPSIS:

This chapter discusses **domestic wastewater characteristics**, presents a general overview of the individual **components of subsurface wastewater disposal systems**, and explains the basics of how they work. This section should be of particular interest to local plumbing inspectors, site evaluators, and excavating contractors and should also provide background to planning board members, regulators and property owners.

TOPICS:

Domestic effluent characteristic, subsurface wastewater disposal system components: building sewer, treatment tank, septic tank filters, grease trap, effluent sewer, distribution box, disposal area, soil treatment of wastewater, stone bed, stone trench, proprietary leaching devices, concrete chambers, plastic chambers, plastic tubing system, Eljen In-Drains, grandfathered systems, distribution systems, gravity flow, pumping siphon, special systems.

DOMESTIC EFFLUENT

Normal household effluent consists of all the liquid household waste that is generated from the toilet, bath, kitchen and laundry. This material is composed of about 99.9 percent liquids and about 0.1 percent solids. The small percentage of solids and the microorganisms are the cause of health hazards and nuisances.

Approximately two-thirds of the solids in domestic effluent are organic compounds, primarily carbohydrates and fats. Organic compounds are the primary source of odors and nuisances, requiring large volumes of oxygen to render them stable, inoffensive, and non-hazardous. Other substances in effluent that are undesirable and potentially harmful are: pathogenic bacteria, infectious viruses, organic matter, toxic chemicals, and excess nutrients, such as nitrogen and phosphorus. These substances are a potential public health hazard, nuisance, and a source of pollution when not properly treated.

The specifications in the *Subsurface Wastewater Disposal Rule* for calculating the size of wastewater disposal fields assume that the waste being treated is of the same quality as normal household wastewater. When it is suspected that the wastewater to be treated is of a different quality than domestic wastewater, the suspended solids and biochemical oxygen demand should be measured and considered for adjusting the disposal area size. If the waste is a by-product of any textile, printing, furniture stripping, metal plating, paint, manufacturing, pharmaceutical,

pesticide, petroleum, leather, rubber, plastic manufacturing or other hazardous waste materials; the application for the disposal system should be directed to the **Maine Department of Environmental Protection, Bureau of Hazardous Materials and Solid Waste Control, (1-207-287-2651)**.

SUBSURFACE WASTEWATER DISPOSAL COMPONENTS

The essential features of a typical system are the building sewer, treatment tank, effluent line, distribution line, disposal area, and surrounding soil (see Figure 1). Many disposal systems also include a distribution or diversion box and some systems also utilize a pumping chamber or siphon.

A properly designed and sited disposal system will provide for adequate treatment and disposal of the wastewater prior to reaching the seasonal groundwater or soil surface. Failure to meet all necessary design criteria introduces a greater probability of failure and higher risk of creating a potential health or environmental hazard.

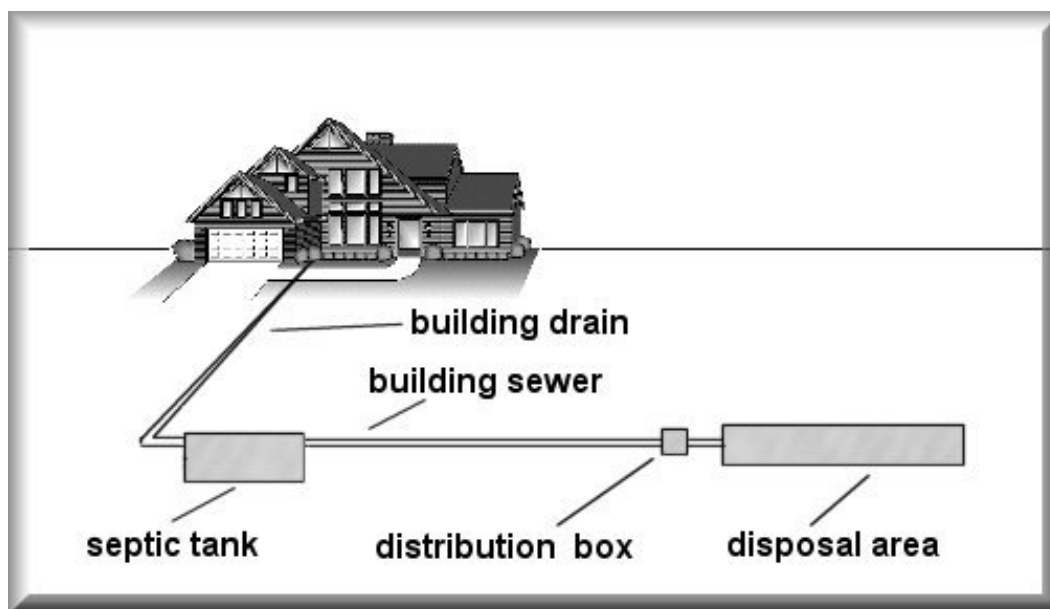


Figure 1: *Essential Features of a Building Sewer*

BUILDING SEWER

The building sewer is a water tight pipeline which is used to convey raw (untreated) wastewater from the dwelling to the treatment tank. It should extend a minimum of 8 feet from the building foundation to allow for ease of installation of the treatment tank. It is also good practice, in designing disposal systems, to keep the length of the building sewer as short as practical in order to reduce the possibility of blockage and to facilitate cleaning of the sewer line if it should become blocked.

TREATMENT TANK

The treatment tank functions as a conditioning device and provides for primary treatment of wastewater. The raw wastewater is detained in the treatment tank long enough to allow it to be rendered more suitable for discharge to the disposal area. If raw wastewater were discharged directly to the disposal area, the solid materials contained in the wastewater would quickly clog the pore spaces between the soil particles. Wastewater that does not percolate between the soil particles either backs up through the plumbing system into the house or comes to the surface of the ground near the disposal area. To minimize the likelihood of this occurrence, the raw wastewater is held for a period of one to three days in the treatment tank where it is subjected to a combination of physical, chemical, and biological actions resulting in the conversion of the solid material to liquids and gases. The gases either escape through the house plumbing vent or mix with the effluent, and the clarified liquid is piped to the disposal area. Some of the solids remain in the tank as sludge or scum and must be removed periodically before they accumulate to the point where reduced retention capacity of the tank results. Reduced retention time of effluent in the septic tank will result in solids carryover to the disposal area. Pumping of the treatment tank every 3 to 4 years is generally considered a good maintenance practice. Some treatment tanks may need to be pumped more or less frequently, depending on the quality and quantity of wastewater generation.

The total solids in wastewater consist of dissolved or soluble solids, suspended or colloidal solids, and settleable solids. The dissolved and suspended solids remain in the wastewater and do not settle out, while the settleable solids are removed from the wastewater by gravity if allowed sufficient time (the reason why septic tanks need to be periodically pumped). Primary treatment, which takes place in the treatment tank, is a settling process in which the settleable solids sink to the bottom by gravitation. Certain materials in the wastewater, known as scum and consisting of paper, grease, and similar constituents lighter than the liquid wastewater, will rise to the top. These materials are prevented from entering the disposal area by baffles or tees designed to trap the floating substances in the treatment tank (see Figure 2).

Septic tanks and aerobic tanks are the two types of treatment tanks recognized for use in Maine. Septic tanks produce an anaerobic environment and rely on anaerobic bacteria for treatment (see Figure 2). Aerobic tanks pump fresh air into the tank and rely on aerobic bacteria for treatment. The bacteria in aerobic treatment tanks, although more active, are also more sensitive and fragile to fluctuating conditions than anaerobic bacteria in septic tanks. Presently, there are very few aerobic treatment tanks used in Maine. Current regulations do not allow for a reduction in the size of a disposal area with the use of an aerobic tank. Aerobic treatment tanks are relatively more expensive, need maintenance, and require electricity.

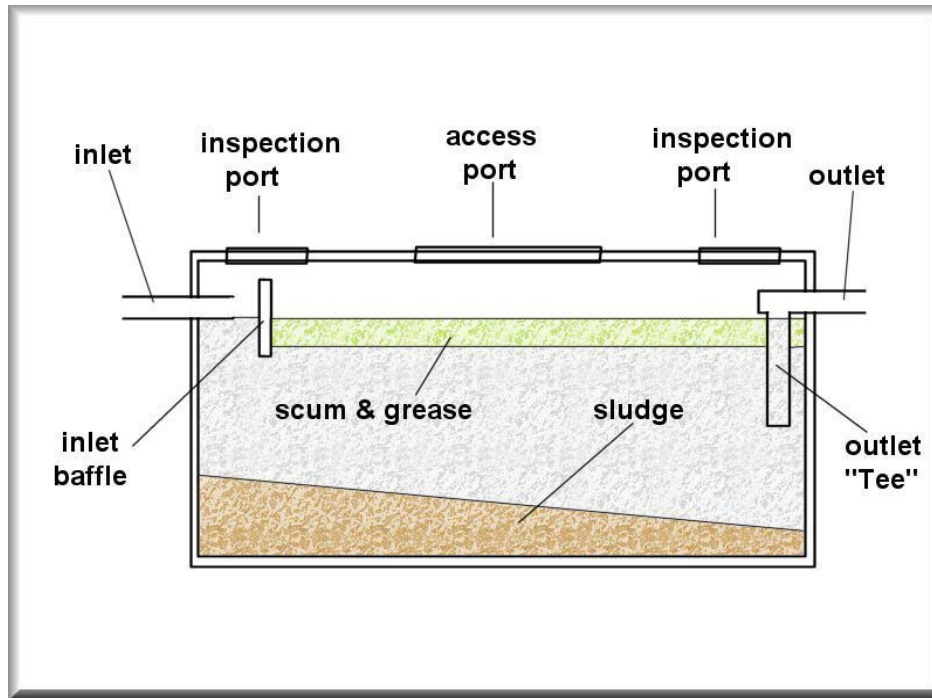


Figure 2: *Cross-section of a typical septic tank*

Treatment tanks must be sited and designed such that they will not be subject to either surface water or groundwater infiltration. The treatment tank outlet should be above the seasonal high groundwater table to prevent groundwater from entering the tank, if at all possible. A treatment tank, placed in a soil that has a seasonal groundwater table above the treatment outlets or covers, should be installed with attention given to preventing surface and groundwater infiltration. Risers with grouted seams and covers should be considered for placement over all openings to prevent groundwater infiltration into treatment tank openings. Treatment tanks should be accessed through the cleanout cover when being pumped, to allow the suction hose to reach all sludge accumulations.

Treatment tanks are commonly made of concrete or plastic. Metal treatment tanks are no longer permitted in Maine. Plastic tanks generally are more expensive, but have several advantages. They are lighter and can be installed in areas inaccessible to heavy equipment, since they can be hand-carried by several adults. However, their lightness can be a disadvantage when being installed in wet sites because they can float when empty. Plastic tanks do not erode over a period of time when exposed to normal domestic wastewater, as do concrete tanks.

Monolithic or one piece treatment tanks are available for use. Monolithic tanks are less likely to leak than standard two-piece tanks. Care should also be taken to plug the small diameter hole in the bottom or side of the tank (commonly referred to as a *bung hole*), which is used to counter flotation when installing septic tanks in wet locations.

SEPTIC TANK FILTERS

There are a number of pre-manufactured filters available which can be installed on the outlet end of septic tanks to prevent carryover of suspended solids to the disposal area. Filters need periodic maintenance to remove solids. Failure to provide proper maintenance may result in wastewater backups into plumbing in the home. However, that risk is usually preferable to the more costly risk of disposal area failure. Refer to manufacturer's manuals for maintenance recommendations (see Figure 3).

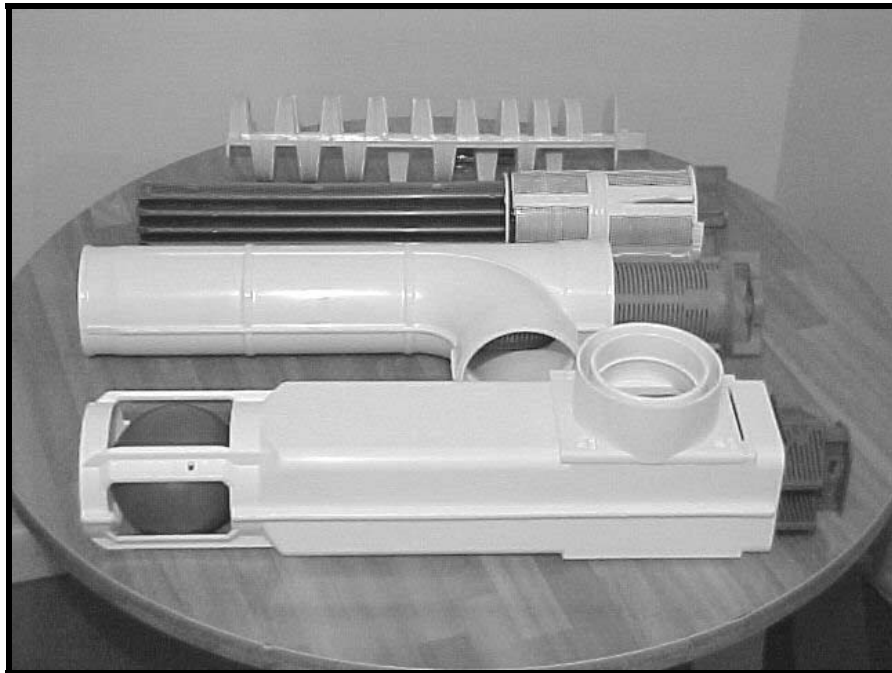


Figure 3: *Septic tank filters*

GREASE TRAP

An external grease trap should be used with systems that will treat wastewater generated from a facility that has a likelihood of producing a significant quantity of grease in the wastewater (e.g. restaurant, school cafeterias). The standard, non-mechanical, internal grease traps have been shown to be ineffective in removing grease. It appears that the liquid cooking oils that are commonly used today are becoming more difficult to trap because they stay in emulsion longer.

An external grease trap essentially consists of a modified septic tank with the baffling modified

EFFLUENT LINE

The effluent line is a water tight pipeline which conveys treatment tank effluent to the disposal area. Disposal areas are generally gravity fed, but in instances where the disposal area is at a higher elevation than the treatment tank, pumping is required. There should be a drop in elevation between the treatment tank and disposal field of 1/8 inch per foot or more with a

gravity effluent line. This drop is to prevent a sluggish disposal area or one exposed to large peak flows from backing up during periods of stress and causing the liquid in the septic tank from rising above the baffles. When the liquid level in a septic tank rises above a conventional baffle, there is an opportunity for solids to flow unrestricted to the disposal area, potentially causing a failure. The greater the elevation drop between the septic tank outlet and the disposal area, the lower the possibility of solids reaching the disposal area by flowing over a conventional septic tank baffle during stress periods.

DISTRIBUTION BOX

A distribution box is utilized to ensure the uniform use of the entire disposal area(s) if more than one disposal line is required in a disposal area, or when using more than one disposal area in an equal distribution system. Distribution boxes also can serve as inspection ports for the elevation of solids carryover or to view liquid levels in a disposal area, and to reduce the velocity of effluent flow in a pumped system.

A distribution box is a small plastic or concrete tank with a single inlet and several outlets located approximately 2 inches below the inlet (see Figure 4).

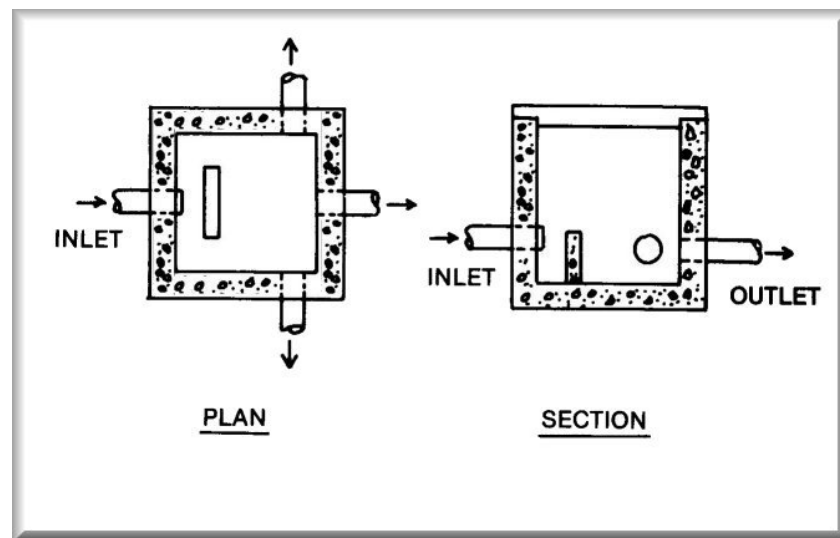


Figure 4. *Distribution box*

Distribution boxes can range from a small 3-outlet box to a larger one containing many outlets. The distribution box may also be fitted with a valve system that allows part of the disposal area to be utilized while the remainder is allowed to rest (diversion box). Resting part of the disposal area or one disposal area/trench will allow for bacterial and chemical decomposition of solids that have clogged soil pores, if sufficient time is allowed.

A distribution box is very useful when inspecting a failing disposal system to determine liquid levels, waste loading, solid carryover, and distribution patterns for possible problems. However, distribution boxes are prone to frost heaving which can potentially cause them to go out of level, resulting in unequal distribution of the flow. A common alternative to a distribution box is a

plastic *tee* fitting or a manifold pipe. The use of a plastic *tee* fitting reduces the potential of frost heaving but eliminates a possible inspection port. Freezing can also be a problem, especially in cold winter months with no snow cover. Insulating the cover of distribution or diversion boxes is required. Connecting the effluent line so that it enters the distribution box from underneath is a method to help prevent freeze-up problems.

DISPOSAL AREA

A disposal area is the component that is comprised of stone or proprietary leaching devices, and is designed to transmit wastewater into the surrounding soil. The partially treated wastewater from the treatment tank is discharged into the soil at a shallow depth by means of a disposal area (see Figures 5 - 12 for examples). The disposal area serves to: absorb the effluent load from the treatment tank, provide a temporary storage area during periods of large water use, and additionally treat the effluent. The disposal area allows the effluent to be transmitted to the soil for final treatment.

Soil Treatment of Wastewater

The soil, into which the effluent is discharged, serves three purposes: distributes and absorbs the effluent; provides microorganisms and oxygen for treatment of the unstable compounds, bacteria and solids; and allows chemical and cation (the interchange between a cation (positively charged ion) in solution and another cation on the surface of any surface active material such as clay or organic matter) exchange reactions that remove nutrients from the wastewater.

When effluent exists the septic tank is anaerobic. It is only partially treated and contains many solids, numerous anaerobic bacteria, viruses, and unstable compounds. Effluent from the septic tank must become aerobic before complete treatment is obtained. Effluent contains anaerobic bacteria and viruses as it moves into the soil area. The population of these organisms is reduced by exposure to an unfavorable environment in the surrounding soil media. Physical filtration of bacteria and viruses is not very effective because they readily pass through soil pores. However, filtration of the organic matter at the soil interface tends to restrict the food supply of bacteria. Aeration of the wastewater as it moves through the soil tends to create an environment hazardous to the survival of anaerobic organisms. The soil may also contain some organisms that are toxic to the bacteria and viruses. Wastewater entering directly into a seasonal water table does not have adequate treatment other than dilution. The *Subsurface Wastewater Disposal Rules* require that a proper separation distance between the bottom of the disposal area and the seasonal high groundwater table be maintained to assure adequate treatment by providing a zone of aeration.

Distribution Piping

The *Subsurface Wastewater Disposal Rules* require distribution piping within all stone disposal areas (beds and trenches). Their purpose is to provide for as even a distribution of effluent as is practical, throughout the disposal area(s). Gravity flow systems have larger diameter pipes while disposal areas that receive wastewater from pumps with pressure distribution throughout the entire area have smaller diameter pipes. For low pressure dosed disposal areas, piping size, spacing, orifice opening diameter, and number are determined by calculations. The *U.S.*

Environmental Protection Agency's Design Manual for On-site Wastewater Treatment and Disposal Systems (EPA 625/1-80-012) is a good reference in making these calculations.

Stone Bed Disposal Area

A stone bed disposal area acts as an underground retention area for effluent. Crushed stone (3/4 to 2 1/2 inches in diameter) is used in the construction of a bed to provide void space for the storage of effluent and to allow it to drain into the surrounding soil (see Figures 5 and 6).

Sizing disposal beds is accomplished by multiplying the design volume of wastewater, expressed in gallons per day, times the size rating parameter determined by the soil profile classification. This will be discussed in more detail in Chapter III.

Beds can vary in width. Narrow beds are more advantageous than wide beds because they increase the sidewall area relative to the bottom area, which allows for a freer exchange of oxygen beneath the disposal area. A more aerobic environment results in development of a thinner biologic mat and correspondingly longer disposal area life span. Groundwater mounding is also less likely to occur in narrow beds than in wider beds. Narrow beds are particularly advantageous for placement on steeper slopes because they reduce the amount of fill required on the downslope side. The advantages of wide beds are that they are more easily installed with mechanical equipment and require less overall area for installation than narrow beds.

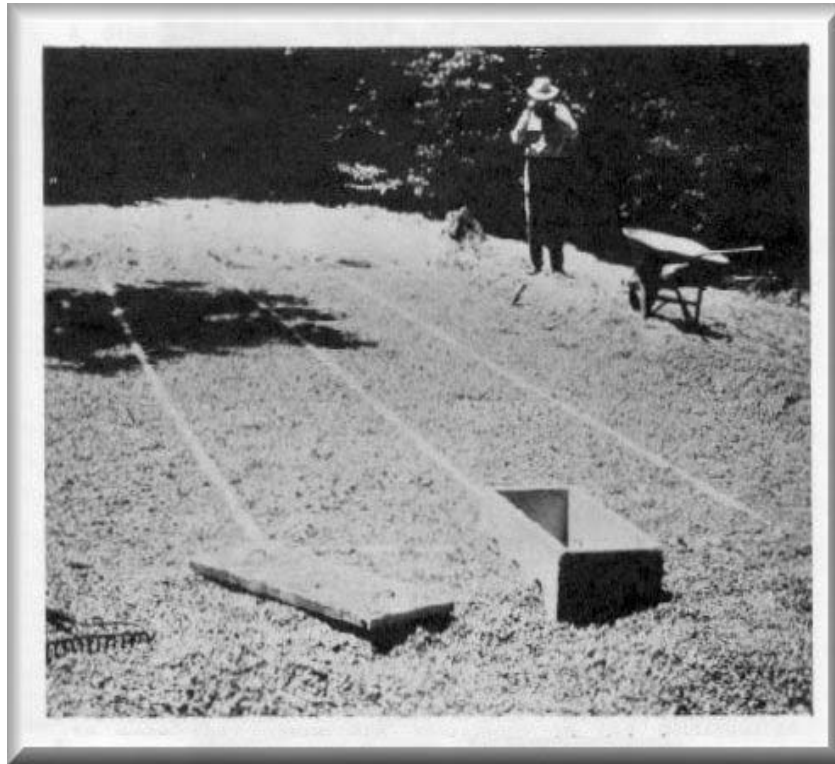


Figure 5: *Stone layer of disposal bed during construction. (Photo by A. Frick)*

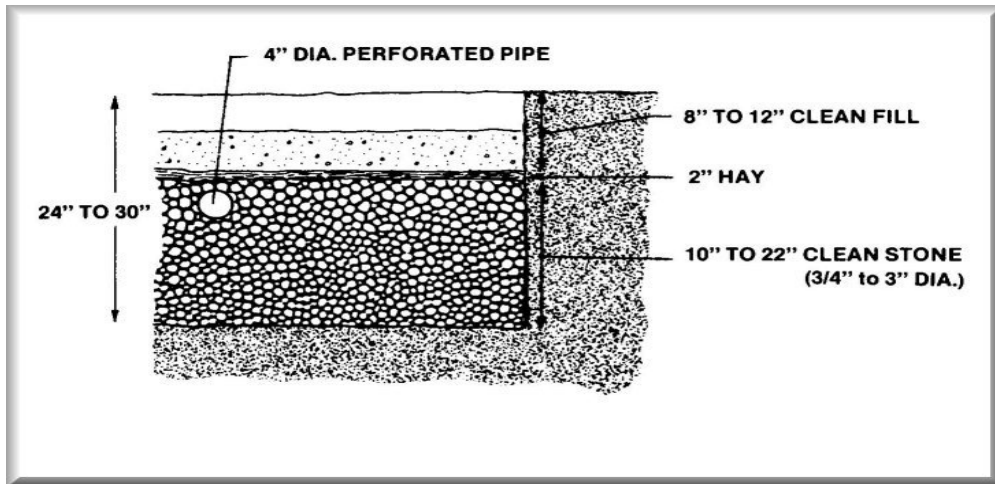


Figure 6. *Cross-section of disposal bed*



Figure 7. *Trench System during construction (photo by A. Frick)*

Stone Trench Disposal Area

A stone trench disposal area is essentially a narrow bed, approximately 2 to 3 feet wide and constructed of the same materials as the bed disposal area. The trench system is only practical on sandy, well drained sites. The stone trench disposal area is more labor intensive than a bed disposal area since it is not as easily suited to mechanized construction; requiring more backhoe time, more land area and manual labor. Trench systems, although unpopular in the late 1970's and throughout the 1980's and into the early 1990's, has become more popular because they do a better job of treatment after considering the underlying ground water table response. This topic is discussed in more detail in Chapter VII, *Special Considerations, Groundwater Mounding Analysis*. The sizing of these systems is discussed in Chapter III (see Figure 7).

PROPRIETARY LEACHING DEVICES

Proprietary leaching devices are pre-manufactured structures of concrete, plastic or other gravel-less material that are used to create a void area within the soil. They replace the stone and distribution lines in conventional bed or trench disposal areas, although piping is still required for low pressure dosed systems. In all other aspects, they are similar to stone beds or trench disposal systems use and function. The Division of Health Engineering requires each product manufacturer to develop an installation brochure as part of the product approval process. Installers should refer to the manufacturer's instructions for installation guidance.

Each proprietary leaching device is rated by percent equivalence to a stone disposal area system, expressed in square feet. Variability in square foot equivalent is also given for each device depending upon disposal area layout. A higher rating is allowed for narrow linear configurations as compared to wider configurations, due to an advantage in the increased sidewall area. The sizing of these systems is discussed in Chapter III.

The advantages of proprietary leaching devices over the conventional stone bed designs are:

- reduced area need for installation 25% to 75%
- reduced fill volumes required for installation
- can be removed and reused to create a new system if failure occurs
- can be installed without stone, an advantage at remote, hard-to-access sites
- can be configured in terraces, stepping down the natural slope of the land
- can be manufactured with sufficient strength or designed so that they may be installed under parking lots or traffic-laden areas. (Systems designed for vehicular traffic must have an H-20 loading rate).

The disadvantages of proprietary leaching devices over the conventional stone bed disposal system may be:

- a higher initial cost
- requirement for special materials or installation techniques

Concrete Chambers

Concrete chambers are rectangular-shaped devices which have four side walls and a top, but no bottom. They are installed using either trench or cluster configurations. Concrete chambers are designed to store effluent discharged from a septic tank. Effluent then infiltrates into the soil beneath them. They can also allow effluent absorption through sidewall areas but only when installed in trenches and with stone applied to both sidewall areas. Concrete chambers are relatively heavy, requiring a lift truck to set them in place, but are quite strong and durable. These devices must meet the same siting requirements as stone beds. They must be installed per the manufacturer's instructions (see Figure 8).

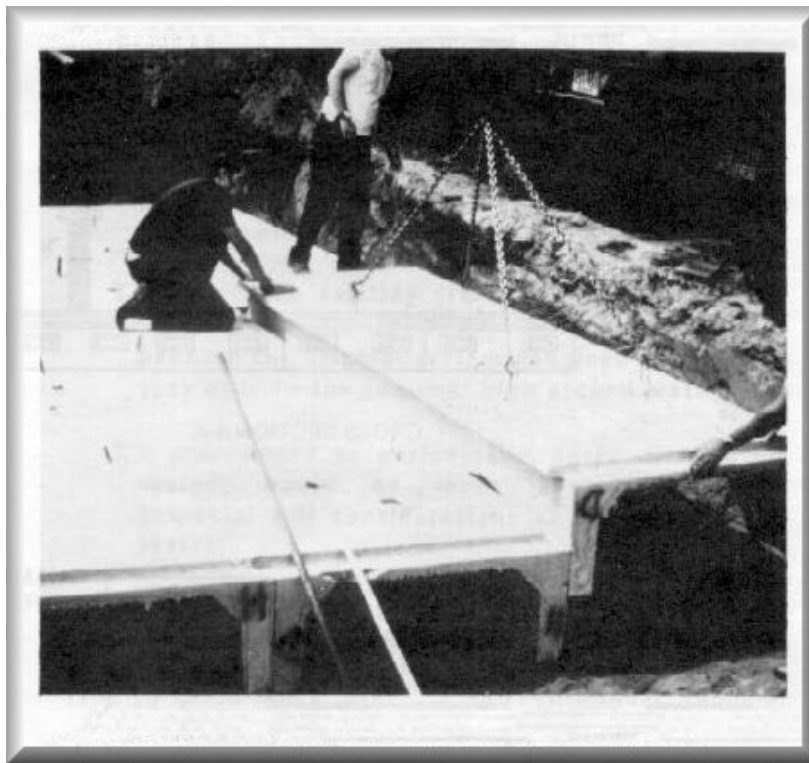


Figure 8. *Concrete chamber system during construction (photo by A. Frick)*

Plastic Chambers

Plastic chambers perform the same function as concrete chambers but are lighter in weight and are designed to take advantage of sidewall area without the use of stone, when used in trench configuration. There are now several companies in Maine which market plastic chambers, in both low and high capacity models, as well as narrow models intended for trench installations. In some instances, H-20 load ratings can be achieved by following manufacturer's directions for backfill and overburden installation. Because they have an unmasked soil interface, chambers are generally allowed a 50 percent reduction in size requirements, compared to a stone bed. Specific sizing specifications are found in the Maine State Plumbing Code, Subsurface Wastewater Disposal Rules.

Plastic chambers can be installed in cluster configuration or in trench configuration, using either serial or parallel distribution. When plastic chambers are used in a cluster configuration, only the unshielded bottom area can be used to determine its standard stone-filled disposal-field equivalent. When plastic chambers are used in a trench configuration, the sum of its unshielded bottom and sidewall area can be used to determine its standard stone-filled disposal-field equivalent. The number of plastic chambers must be rounded up to the nearest whole chamber. Although plastic chambers are generally designed to eliminate the need for stone in a disposal area, many Site Evaluators and installers prefer to place stone alongside the chambers, to prevent migration of backfill into the chambers, through the louvers. Some also prefer to place the chambers on a layer of stone or gravel, however, if this is done, the system must be sized as a conventional stone bed. In installations where stone is used with plastic chambers, setbacks are measured from the stone boundary, rather than the plastic chambers. Designers are strongly advised to contact the manufacturer or distributor prior to use of stone in designing a plastic chamber system. Specific sizing specifications are found in the Maine State Plumbing Code, Subsurface Wastewater Disposal Rules. (see Figure 9).



Figure 9. *Plastic chamber system Highmoor Farm demonstration site in Monmouth, Maine*

Plastic Tubing System

Plastic fabric covered tubes have been approved for use in Maine since June of 1989. This system consists of corrugated plastic pipe with outlets arranged along the outside. The plastic pipe is covered with a plastic mesh and wrapped in a non-woven filter fabric, to prevent

migration of soil particles into the pipes. Because the fabric covered pipes have an unobstructed void space, they are allowed significant reductions in sizing. They are designed to be installed in trenches because they rely heavily upon sidewall area. They have an advantage of being able to follow a contour more closely than other, more rigid systems. Specific sizing specifications can be found in the Maine State Plumbing Code, Subsurface Wastewater Disposal Rules. Plastic tubing systems must meet the same siting requirements as stone beds and must be installed as per the manufacturer's directions (see Figure 10).



Figure 10. *Plastic Tubing System during construction at Highmoor Farms demonstration site. Under normal conditions two models of fabric covered tubing would not be installed in the same system. Also, different models of fabric covered pipe are not interchangeable. When a site evaluator calls for a certain model of fabric covered tubing that model must be installed according to plan.*

Cuspated Blocks

Cuspated Blocks are plastic devices that utilize a large surface area to treat effluent so that a relatively small infiltrative area is required. The cuspated block system is constructed of plates of cuspated plastic, which somewhat resemble egg cartons. Non-woven filter fabric is interlaced between the cuspated plates. The fabric and cuspated plates are then bound into blocks. The fabric provides a large surface area upon which a biomat is established. Once established, the biomat provides a high degree of treatment of the effluent due to its high surface area to footprint ratio. This favorable ratio also allows for a significantly reduced disposal area size. Specific sizing specifications can be found in the Maine State Plumbing Code, Subsurface Wastewater Disposal Rules. (see Figure 11).



Figure 11. *Eljen In-Drain system during construction at Highmoor Farm Demonstration site, Monmouth, Maine*

DRIP IRRIGATION

The major design differences between conventional disposal systems and drip irrigation systems are a relatively uniform distribution of effluent and shallow placement of trenches. To avoid or minimize clogging of the disposal lines, both types of drip irrigation systems must be preceded by pretreatment that conforms to the manufacturer's specifications. Subsurface drip irrigation systems are able to distribute effluent at low application rates over the entire absorption field, which can prevent saturation of the soil and thereby facilitate aerobic treatment. Wastewater is applied in the plant root zone, which minimizes percolation of the effluent and in certain conditions accommodates evaporation and absorption of the effluent by the surrounding plants. Small vibratory plows or trenchers ("ditch witches") may be used to install drip emitter lines.

DRIP IRRIGATION: SOAKER HOSES

In late 1999, drip irrigation systems began to be used in significant numbers in Maine, primarily of the shallow trench porous soaker hose variety (Figure 12). The porous soaker hose system uses the soaker hose to dispose of very highly treated and disinfected effluent from an advanced treatment unit. This system is intended for installation at or above grade, either in the site's organic soil strata (duff layer) or backfilled with bark mulch. Because of the very shallow depth at which the soaker hoses are installed, the system is approved in Maine for seasonal use only to avoid freezing problems. The soaker hose systems are subject to the minimum site evaluation,

setbacks, and separation distances in the Maine State Plumbing Code, Subsurface Wastewater Disposal Rules. Specific sizing specifications are found in the Maine State Plumbing Code, Subsurface Wastewater Disposal Rules.

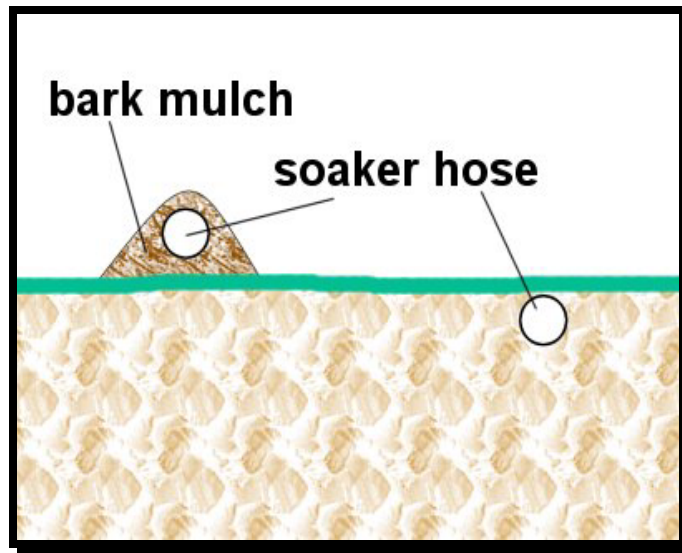


Figure 12. *Porous soaker hose drip irrigation system.*

DRIP IRRIGATION DRIP EMMITTERS

Another variety of drip irrigation system approved for use in Maine is the drip emitter system. The drip emitter system uses small diameter piping ($\frac{1}{2}$ inch diameter) with integral flow velocity reducing drip emitters. Drip emitter systems are installed in a grid consisting of a supply header and a flush (return) header. Emitter lines are installed parallel to each other, between the two headers. The number of emitter lines varies according to design flow. A series of proprietary valves and flushing devices are used to regulate flow and to back flush the system for prevention of solids accumulation in the emitters. The drip emitter systems are subject to the minimum site evaluation, setback, and separation distances in the Maine State Plumbing Code, Subsurface Wastewater Disposal Rules.

GRANDFATHERED DISPOSAL SYSTEMS

There are numerous *grandfathered* disposal systems still in use today. A *Grandfathered* system is one which no longer is permissible for installation and was constructed prior to the existing *Subsurface Wastewater Disposal Rules*. A grandfathered system is permitted to continue to exist until the system malfunctions, at which time it must be upgraded to current standards.

DISTRIBUTION SYSTEMS

Once effluent leaves a treatment tank, it must be directed to a disposal area by means of gravity flow, a pump, or a siphon.

Gravity Flow

The preferred means of directing effluent to a disposal area for small systems is by gravity flow from the septic tank. Gravity flow eliminates the need for a mechanical device, which adds cost and has the potential to breakdown or become inoperative with a power outage.

The disadvantages to gravity flow are: it does not provide equal distribution of effluent throughout the entire disposal area and it must be directed to a disposal area located downslope of the effluent source.

Pumping

Pumping is necessary when the treatment tank outlet is lower in elevation than the proposed distribution line or when pressure distribution is required. Pumps raise the elevation of wastewater and allow it to enter a disposal area when gravity flow is not possible. Pumps also provide for periodic dosage or pressure distribution. Pressure distribution results when dose volumes are matched with distribution pipe sizes and hole sizes in distribution pipes, so that effluent is forced into every part of the disposal area equally. *Pump systems* are more expensive than *gravity flow* systems. They also require electricity and periodic maintenance (see Figure 13).

Pumping stations should be sited in locations and at elevations which are not subject to either surface or groundwater infiltration. If this is not possible, provisions should be made to prevent infiltration by sealing and/or intercepting and diverting the water source.

In systems that require pumping, an effluent pump is usually placed on the outlet side of the treatment tank or within the treatment tank to pump wastewater to the disposal area, after the solids have settled out. A sewage grinder pump or sewage ejector can be placed on the building sewer drain to pump raw sewage, which contains solids, to a treatment tank. It is usually preferable to install an effluent pump when feasible rather than a sewage grinder pump or sewage ejector. Sewage grinder pumps and sewage ejectors are more costly than an effluent pump. They also require that the septic tank capacity be increased or a dual compartment tank be installed to provide for adequate primary treatment (see Figure 14).

Occasionally, a sewage ejector or grinder pump is installed within the basement of a structure to avoid setback conflicts associated with the septic tanks. Care must be taken to utilize a pump, which has been properly sized, to accomplish the task of getting the wastewater to the desired elevation. Selection of the correct pump requires knowledge of head and friction loss calculations (see Figure 13).

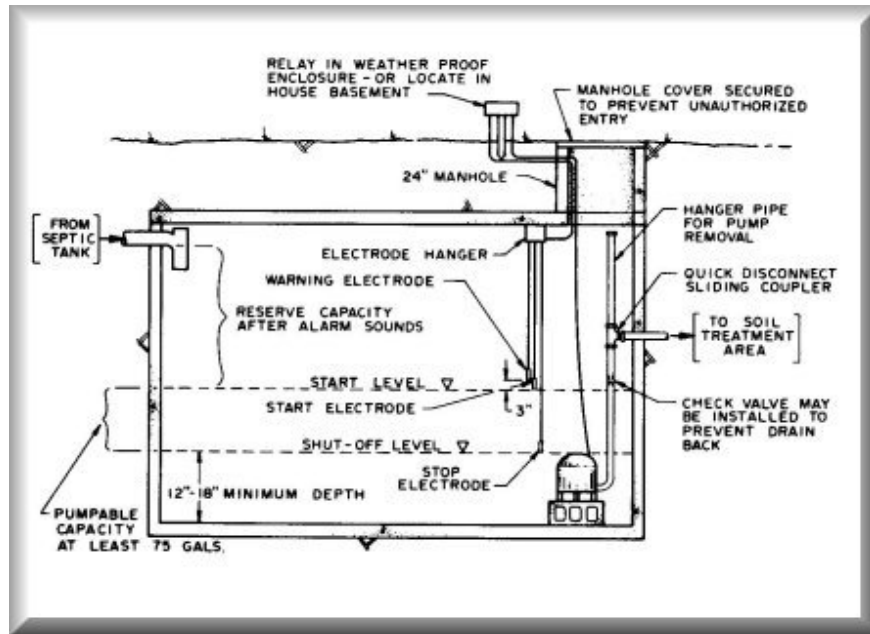


Figure 13. Pump tank and effluent pump

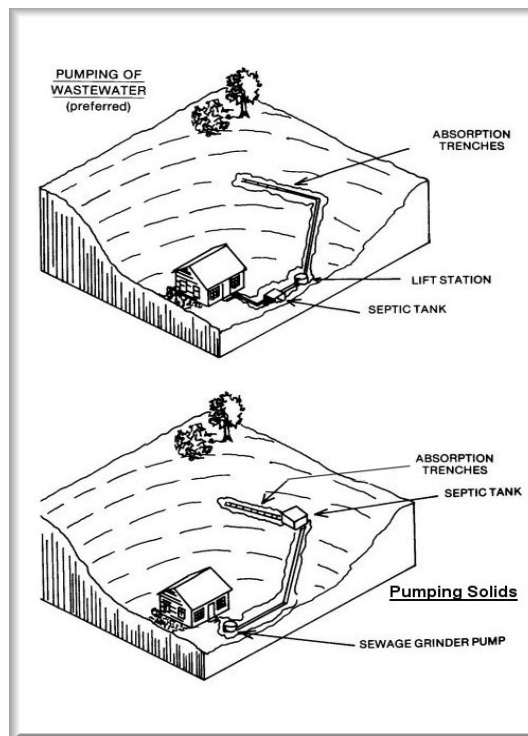


Figure 14. Design layouts of effluent and sewage lift stations

Siphon

A dosing siphon is non-mechanical and has no power requirements; however, it has no lifting ability and is relatively difficult to install properly and maintain. A dosing siphon only can be used when the disposal area is below the elevation of the outlet of the dosing tank. The advantage of dosing tanks is that they can provide for periodic dosage or pressure distribution to a disposal area(s) without electricity. Siphons are not commonly used in Maine.

SPECIAL SYSTEMS

Systems that do not include all of the standard features of a subsurface wastewater disposal system, including building sewer, septic tank, effluent line, and disposal area are considered special systems.

Alternative Toilets

Pit Privies:

Pit Privies (commonly referred to as outhouses) are in-ground (soil based) systems designed to dispose of black wastewater only. They do not require piping or water for waste transport. Pit privies consist of an excavation below the ground surface or within fill, depending upon depth to limiting factor, and an enclosed vented building. Accumulated waste materials must be periodically removed from the excavation and then should be disposed of in an approved manner (see Figure 15).

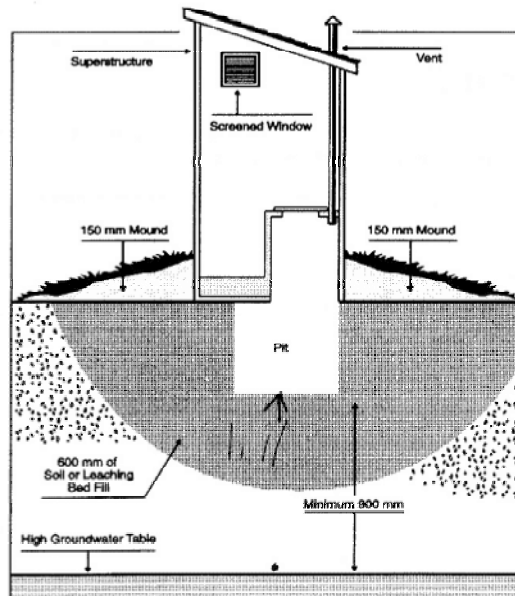


Figure 15. *Pit privy*

Sealed Vault Privies:

Sealed vault privies are similar to pit privies in all respects except that the enclosed building sets upon a watertight tank. Black waste is directly deposited into the tank that must periodically be emptied in an approved manner. They are typically used at sites where soil-based systems cannot be installed

Wet Willeys:

Wet willeys are basically pit privies, without an enclosed building. They are intended to be used only in remote, lightly-used, primitive campground or backpacking areas which are under the jurisdiction of the Maine Bureau of Public Lands. Wet Willeys are comprised of a small excavation over which a seat with a hole in it is placed.

Composting, Incineration and Peat Toilets:

There are several waterless toilets approved for utilization in the State of Maine. Please refer to the *State of Maine, Subsurface Wastewater Disposal Rules* for the complete list of approved alternative toilets

Holding Tanks

Holding tanks are watertight receptacles for the temporary storage of black and/or gray wastewater. Their use in Maine is restricted to situations where other subsurface wastewater disposal methods are not possible or practical. Holding tanks are relatively expensive to maintain if they are subject to continual or large wastewater volume generation.

Gray Water Systems

Gray waster disposal systems are designed to treat and dispose of only gray water. The construction on these systems is identical to combined waste systems in that they require a building sewer, septic tank, effluent line and disposal area.

Laundry Disposal Areas

Laundry disposal areas are designed to treat and dispose of gray water only from washing machines from residential dwellings. They do not require a septic tank but in all other aspects are similar to disposal systems for combined wastewater treatment. Though a treatment tank is not required, it is recommended that a lint filter be used with laundry disposal systems.

Temporary Alternative Toilets

Portable chemical toilets, chemical privies or holding tanks may be used for fairs, carnivals, mass gatherings, encampments or other locations where people congregate for short periods of time, plumbing permits are not required nor is approval of the LPI.

Primitive Disposal Systems

Primitive disposal systems are systems that are designed to dispose of gray waste from a plumbing fixture such as a sink or shower that is served by water which is hand carried or hand-pumped. They are based upon a minimum design flow of 25 gallons/day per fixture, for up to 3 fixtures, and cannot rely upon an energy source for providing water. They do not require a septic tank and must have a building sewer/effluent line no greater than 2 inches in diameter. Primitive systems for new construction require the determination of a full-sized reserve disposal area can be installed in the event that pressurized water is desired in the future.

ALTERNATIVE TREATMENT

There are new and emerging on-site wastewater technologies that can be grouped into four broad categories:

- methods to enhance primary treatment
- methods to promote better wastewater distribution
- methods to improve effluent quality in advanced treatment steps
- methods to enhance wastewater dispersal and treatment in disposal areas

The *State of Maine, Subsurface Wastewater Disposal Rules* allow for a reduction in the required disposal area if an applicant can provide documentation that the wastewater quality can be improved by reducing the wastewater *strength* by reducing solids (TSS) and the biological oxygen demand (BOD). Brief examples of the many new emerging technologies are with advanced treatment technologies are:

- aerobic units
- biofilters (peat, foam, sand)
- composting toilets
- constructed wetlands

Peat Filters and Beds

Partially decomposed sphagnum moss, commonly referred to as peat, is a recognized medium for the treatment of septic tank effluent and is allowed by the State of Maine, Subsurface Wastewater Disposal Rules in the design and construction of disposal areas and pretreatment filters. Unique features of peat systems are:

- wastewater treatment occurs in the peat itself, by microscopic fungi;

- the clogging mat is not as hydraulically restrictive as in other types of disposal systems;
- water movement occurs throughout the entire disposal field, in all directions;
- they provide for greater nitrate reductions than in other types of disposal systems.

The *State of Maine, Subsurface Wastewater Disposal Rules* provide specific directions for the design and installation of peat disposal areas and pretreatment filters.

Sand Filters

Historically, sand filters were approved by the Department of Environmental Protection in the State of Maine for treatment of wastewater prior to discharge to an approved surface water body as a licensed overboard discharge. New overboard discharge systems were prohibited in the late 1980's; however, the use of the sand filters was redirected toward pretreatment of wastewater prior to disposal to a septic field.

II. SITE EVALUATION

SYNOPSIS:

This chapter discusses elements considered in evaluating a potential subsurface wastewater disposal system site. This section should be of particular interest to site evaluators and local plumbing inspectors. This chapter also can provide background information to excavating contractors, planning board members, regulators, and property owners.

TOPICS:

Site evaluation practice, field equipment, Minimum Lot Size Law, water body classifications, setbacks, fill calculations, design and field layout, evaluation reference point.

The practice of Site Evaluation is both an art and a science. It is an art in that the Site Evaluator must work simultaneously to design a disposal system that meets minimum code requirements, fits the design in with the natural landscape, and accommodates the property owners needs and interests. It is a science, in that the Site Evaluator must be knowledgeable about soil science principles to make judgments regarding soil suitability for subsurface wastewater disposal and system design parameters. A Site Evaluator must be part engineer in order to accurately determine design flows, wastewater quality, and to properly design a disposal system in compliance with the rules. Also, a Site Evaluator should work to accommodate the owners' specific needs and usage patterns. The Site Evaluator must be very familiar with the *State of Maine Subsurface Wastewater Disposal Rules*, including policies developed by the Department of Human Services, Division of Health Engineering, Wastewater and Plumbing Control Program, which is the State agency that has statutory jurisdiction over subsurface wastewater disposal in Maine. All these disciplines are applied as a Site Evaluator evaluates each parcel of land with its own unique set of characteristics and limitations.

The most efficient and effective way to conduct a site evaluation is for the Site Evaluator and applicant (property owner, prospective buyer, real estate agent, developer) to meet on the lot. In this way, the Site Evaluator can work more closely with the applicant to meet his or her needs, as well as, explain why a preferred option may or may not be feasible, and allow the applicant to select from remaining alternatives. At a minimum, the Site Evaluator and applicant must communicate so that the applicant's needs are fully understood by the Site Evaluator. It can also be beneficial to invite the Local Plumbing Inspector to the on-site investigation so that he or she can become familiar with the site and can answer questions regarding local ordinances or requirements that may arise. Some towns have adopted an ordinance requiring that the Local Plumbing Inspector be notified of scheduled on-site investigations. The Site Evaluator and Local

Plumbing Inspector working together in the field make the permitting process smoother, particularly on difficult or controversial sites.

LOCATION OF THE PARCEL OF LAND

Local Plumbing Inspector's and other reviewers of a parcel of land may not always be familiar with its location. Therefore, it is necessary to include a site location map on the subsurface wastewater disposal application. Pertinent landmarks and intersections are noted with distances between them. For new system variances, a copy from a topographic sheet or the **Maine Atlas** is also required, showing the site location.

ARRANGEMENTS AND AGREEMENTS

In order for a Site Evaluator to conduct a successful on-site investigation, prior arrangements and agreements must be made. These include date and time of the on-site, whether or not the applicant or their agent will meet the Site Evaluator at the property, method for excavating test pits, who will notify **Dig Safe** (if applicable) regarding use of mechanized equipment, scheduled date for completion of necessary forms, fees charged and what they cover, research of local ordinances that may impact the proposed use of the property, and permits which may be required from local or State agencies. Both the Site Evaluator and applicant should reach an agreement regarding scope of services prior to the initiation of an on-site investigation. (For additional information on **Dig Safe**, see Chapter V.)

SITE SELECTION CONSIDERATIONS

There are many variables that must be considered by a Site Evaluator when selecting a site for a subsurface wastewater disposal system on a parcel of land. These include unique site characteristics or limitations, the applicant's needs or interests and compliance with the *Subsurface Wastewater Disposal Rules*. At a minimum, the following must be considered when selecting a disposal system site:

Size of Lot

The size of a parcel of land will have a direct bearing on the selection of a site for a disposal system. Small lots have sites with limited potential due to setback limitations, particularly if a structure is already located on the property. The Site Evaluator should note property line bearings and dimensions. If possible, a copy of a plot plan or tax map should be used.

Type of Proposed Development and Size

In order to properly design a disposal system, it is necessary to determine the size and type of development proposed. For example, is the proposed development a single family dwelling (2 bedrooms), restaurant (30 seat capacity), apartment complex (30 units), and what are the characteristics of the wastewater, if different from normal domestic wastewater?

Land Use Considerations (Proposed, Future)

Consideration should be given to future or existing land use activities on the property when siting a disposal system. Garden plots, firewood storage, vehicular traffic, potential building expansions, future swimming pool location, and other activities may affect layout of the system to some extent.

Applicant's Needs or Interests

The Site Evaluator should determine if there is a conceptual development plan with regards to road access, driveway and parking layout, type and proposed elevation of foundation (e.g. slab, crawl space, full foundation, daylight basement, walk-out basement), and grading schedule to help to determine a feasible site. It may help to determine the desire for internal plumbing in the basement floor in order to try to meet gravity flow.

Generally, the applicant will have a preference where the building should be located, if soil conditions will accommodate. First consideration should be given to the desired location. However, if limited suitable soils are available, the Site Evaluator may have to recommend alternative plans for the applicant so that the disposal system can be sited in accordance with the Rules. The Site Evaluator also should discuss disposal system options with the applicant so he/she can provide input selecting an appropriate design. For example, the applicant may prefer to pump to a distant site as compared to having an above ground disposal area that will appear as a mound on the property near the development.

Zoning and Local Ordinances

A site Evaluator must be aware of local ordinances and town zoning. Some communities have adopted local ordinances that are more stringent than the State's Rules regarding setback distances and minimum soil conditions, and have passed ordinances requiring that the Local Plumbing Inspector be notified of any scheduled on-site visit so that he or she may attend, if scheduling permits. There may be the need for additional local and State Permits regarding either soil testing or installation of the disposal system. It is the Site Evaluator's professional responsibility to notify the property owner of the potential need for any known additional permits associated with subsurface wastewater disposal system installation.

Easements

There are instances when an easement or abutting land, with suitable soils for installation of a disposal system, is required for proper wastewater disposal. An easement must be filed in the Registry of Deeds so that a disposal system can be installed and maintained on the consenting abutter's property. Permission from abutting landowners should be secured prior to any soil testing or site work to avoid problems with trespass.

Minimum Lot Size Law

The Division of Health Engineering, Wastewater and Plumbing Control program also administers the Minimum Lot Size Law. This law states that no person shall dispose of wastewater from any single-family residential unit by means of subsurface wastewater disposal unless such lot of land contains at least 20,000 square feet. In addition, for properties that abut waterbodies, 100 feet of frontage is required for each 300 gpd of wastewater generated. An exception is made for lots of record which contain less than 20,000 square feet, but which meet all other requirements of the Rules.

The legislature modified the Minimum Lot Size Law in 2003 to authorize the Local Plumbing Inspector in municipalities and unorganized territories to approve the installation of subsurface wastewater disposal systems on lots that are less than 20,000 square feet providing certain criteria are met. These criteria are: a) Must have a current HHE-200 form, b) the system meets “first time” requirements, and c) the system is not an engineered disposal system. If the criteria are not met, the approving body is the Department of Human Services. The law also authorizes the municipality to charge a review fee not to exceed \$50 per review. This law did not change the DHS review for less than 100’ of frontage

For multiple unit housing or other land use activities, the lot must have 66.66 square feet of land area for each gallon per day of wastewater generated, and one foot of shore frontage for each 3 gpd of wastewater generated. Applications for waivers are needed if the required lot size versus wastewater generation ratio cannot be achieved for the proposed use, and the lot is not grandfathered.

Location of Water Bodies

It is the responsibility of the Site Evaluator to locate and classify all waterbodies on a property within 100 to 300 feet of the proposed disposal system and to ascertain whether they are major or minor waterbodies. Major waterbodies, those that are depicted on a 7.5 minute U.S.G.S. Topographic Map, require further setbacks from disposal system components than minor waterbodies (those not depicted on a 7.5 minute U.S.G.S. Topographic Map). The Site Evaluator must also locate all drainage ditches and drainage swales for appropriate setback purposes.

It is also the responsibility of a Site Evaluator to locate proposed disposal areas outside of wetlands and an adequate distance back from the wetland edge, as regulated by **U.S. Army Corp and/or Maine Department of Environmental Protection**. Maine DEP regulates all wetlands and many require a minimum of a 25-foot buffer, except for replacement disposal system installation, when no practical alternative exists. In addition, no fill material may be eroded into the wetland. If the Site Evaluator is not adequately trained to identify and delineate wetland boundaries, he or she should inform the applicant that work conducted is contingent upon an opinion rendered by a trained wetland professional as to the delineation of the wetland boundary, so that setbacks can be measured or established. See the section on Wetlands in *Special Consideration* (Chapter VII) for further details.

Slope of Terrain

Disposal areas are permitted on slopes of up to 20 percent by the *State of Maine Subsurface Wastewater Disposal Rules*. Disposal areas must be sufficiently set back from steep downhill slopes to allow for proper construction of the disposal area and fill extensions.

Surface Drainage

Surface drainage characteristics must be taken into consideration in the design of a system for it to function properly. Position in landscape can be used to make assumptions about surface drainage. In general, the greater the contributing watershed, the greater the potential for surface drainage to impact a site. Other contributing factors are roof runoff, road or driveway runoff and runoff from landscaping activities. Consideration of runoff rate and direction is necessary for planning diversion ditch locations. It is necessary to divert surface water away from an area considered for wastewater disposal.

SETBACKS FROM WELLS

Disposal systems are required to be set back 100 feet from wells and other sources of drinking water supplying less than 1,000 gallons per day (gpd), 200 feet from those supplying between 1,000 and 2,000 gpd, and 300 feet from those exceeding 2,000 gallons per day. Disposal systems are required to be set back at least 300 feet from any public water supply source, regardless of supply volume. The Site Evaluator must also insure that the proposed location of the disposal system will not prohibit the property owner from having a reliable water supply on the property. Consideration should be given to any limitations it may place upon abutting properties.

NATIVE VEGETATION

Native vegetation is often used as a general indicator of soil drainage conditions. Generally, the presence of alders, sedges, willows, cattails, and other vegetation typically found in wetlands suggest poor drainage conditions. The prevalence of tree throws and blow downs often indicate the presence of shallow soils or poor drainage. The presence of small knolls and depressions “micro relief” may indicate poorly to somewhat poorly drained conditions. An unexpected lack of vegetation may indicate droughty conditions, shallowness to bedrock, or disturbed soil. (See the discussion of wetlands in Chapter VII, *Special Considerations*, for more detail).

POSITION IN LANDSCAPE

An important consideration for the location of a subsurface wastewater disposal system is position in landscape. Sites on knolls are favorable because they have small contributing watershed and allow effluent to move away from the disposal area so that hydraulic overloading is not a likely threat. Sites in depressional areas typically are collection points for runoff and/or groundwater; and therefore hydraulic failure is a greater concern. Level sites located at the base of slopes may receive substantial runoff from upland areas. Side slopes, at the base of long slopes, can also be subjected to large amounts of runoff. Limitations of less favorable sites can

be overcome by appropriate engineering techniques, if the limitations are correctly identified. Typically, curtain drains, surface water diversions, and/or the use of fill are utilized to overcome runoff problems. (see Figure 16).

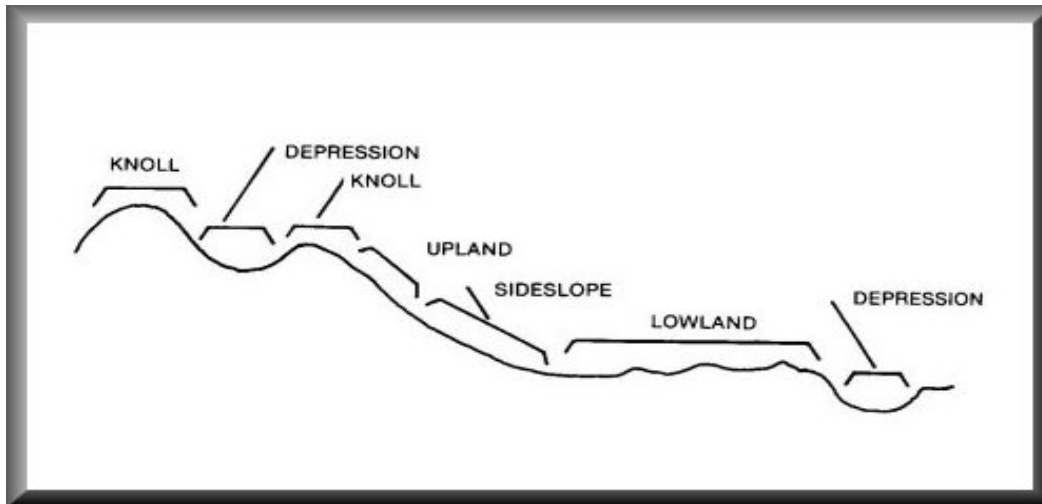


Figure 16. *Position in landscape*

FLOODPLAINS

A Site Evaluator must be able to recognize floodplain zones (areas prone to seasonal flooding). System installation is prohibited or restricted on some flood plains. (see Chapter V, *Flood Plains* for more information). Referencing published soil surveys can be useful in determining where to expect flood plain soils. Contact the Soil and Water Conservation district office in the county where you are working. Federal Emergency Management Agency (FEMA) maps are also useful in determining flood zones.



Figure 17: *Floodplain*

BEDROCK OUTCROPPING

Note outcroppings of bedrock since they typically indicate the presence of shallow soil depths in the vicinity of the outcrop. Landscape and bedrock surface contours can affect drainage conditions of shallow soils. A depression in the bedrock beneath the ground surface can collect groundwater to create poor drainage conditions in that localized area. Also, the potential to impact bedrock aquifers is significant when fractured bedrock is located beneath shallow soil cover. When bedrock is shallow or bedrock outcropping is prevalent, more than one test pit or soil probe should be used to determine representative soil depth conditions. The Rules require a minimum of 12 to 15 inches of suitable soil above bedrock to pass a site evaluation. The Rules require a minimum of 24 inches of suitable mineral soil beneath the entire proposed disposal area when constructed.

LOCATION OF OBSERVATION HOLES

A Site Evaluator must make soil observations within a proposed disposal area to determine soil conditions (see Figure 18). Professional discretion is used in determining the location and number of observation pits. Generally, shallow to bedrock or marginal conditions require several test pit evaluations. Larger disposal systems generally require a more comprehensive on-site soil review. Experience in field evaluation is useful for predicting soil characteristics with relation to landscape, geology, slope and vegetation. Measurements to observation holes must be made on-site so that their accurate location can be shown on the site plan.

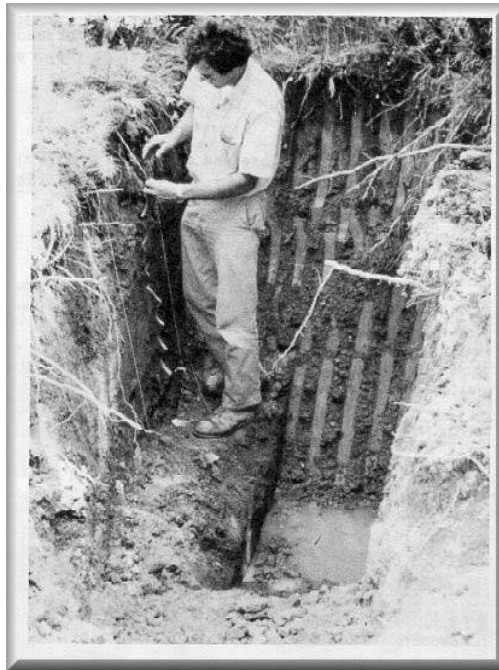


Figure 18. *Site Evaluator logging soil profile description (Photo by Russell Martin)*

PUBLIC RELATIONS

Site Evaluators should explain to the client what a site evaluation entails and the reasons for the investigation. It is important to discuss your field observations in relation to the requirements of the Rules so that the applicant gains an understanding of the site evaluation process. It also helps the Site Evaluator to maintain good public relations. The more information the client is given about the soil and site conditions, the more he or she can understand the disposal system design and construction needs. When more than one disposal system option is available, the client should be provided with sufficient information to make an informed choice.

DESIGN AND FIELD LAYOUT

The Site Evaluator should have a complete understanding of the proposed project before undertaking the investigation of site and soil conditions. The Site Evaluator can then select the most appropriate system, based upon soil and site conditions, to meet the client's needs. Stakes or temporary markers are placed in the corners of the proposed disposal area to aid the contractor or developer in locating the site. Swing ties are taken for more permanent location of disposal field corners.

Systems parallel to the ground contour are preferable, as they require less fill. Shallow, long, narrow systems take advantage of the more friable topsoil horizons, reduce the potential for groundwater mounding, and have more sidewall area.

The Evaluator must record on the Subsurface Wastewater Disposal Application (HHE-200 Form), all of the pertinent features of the site that influence the design of the system. Important features (existing building wells, water bodies, test pits, property lines, etc.) are measured and located from permanent markers. The proposed corners of the disposal system are located by taking at least three measurements from two or more permanent, known, fixed control points (corner property marker, telephone pole, existing corner of building, tree that has been flagged and located and recorded as to type, diameter, etc.). A Site Evaluation is not complete until all of the necessary information has been gathered and reported on the soil and site characteristics.

ELEVATION REFERENCE POINT

An **elevation reference point (E.R.P.)** is required to indicate the finished elevation of a system. A permanent marker should be used for establishing a reference elevation. When there are existing dwellings or structures, the top of the building foundation or a concrete slab is a very good choice. On undeveloped lots, it is often necessary to set an elevation reference point with a nail in a tree on the property or some other available permanent marker.

Establishing an elevation reference point is typically done with a hand level for small systems. A transit or tripod mounted level should be utilized if the system is large, the grade variations between sections of the disposal area are not within the eye level range of the Site Evaluator, and/or the proposed marker to be utilized as the elevation reference point is at a significant distance. A record of the point used must be recorded. If the point is a nail or some type of

marker, capable of being moved, then it is recommended that the relative height of the elevation reference point be noted. This height should be taken from the existing ground beneath it, so that any tampering can be easily detected.

A Site Evaluator must choose a location for the elevation reference point that will not be destroyed or disturbed during construction of the proposed area. If possible, the elevation reference point should not be within the limits of the disposal area fill extension.

SITE ACCESS

Access to the proposed site by trucks and heavy equipment necessary to construct the disposal system should be considered. If the site is not readily accessible with conventional equipment, due to distance between buildings, bedrock outcroppings, steep grades, drainages, etc., it should be noted on the plan and special considerations discussed. Also, other problems such as the need to acquire temporary access across abutting property, temporary repositioning or removal of outbuildings, requirements for hand-carrying, access in frozen conditions, temporary bridging, or other special considerations which are generally out of the ordinary, should be duly noted on the plans to advise the applicant, contractor, and inspector. Remote islands, small lots with limited spacing between buildings, and steeply sloping terrain are typical examples of special access problems.

III. SOIL EVALUATION

SYNOPSIS:

This chapter discusses basic principles of soil science, such as what a soil is, how to recognize and describe soil characteristics, and how to classify a soil for subsurface wastewater disposal purposes in Maine. This section should be of particular interest to site evaluators and should be of background interest to local plumbing inspectors, excavating contractors, planning board members, and property owners.

TOPICS:

Soil definition, soil profiles, soil formation, soil texture, soil structure, soil consistence, restrictive layer, wastewater movement in soil, soil parent material, seasonal water table, soil drainage classes, soil color, soil mottling, soil classifications, disposal area calculations, fill calculations.

SOIL

Soil is the upper weathered and biologically molded part of the earth's crust that supports plant growth. Soil consists of solids, water, and air. The average mineral soil is comprised of 50 percent by volume solids, of which approximately 45 percent is mineral and 5 percent organic. The remaining 50 percent is comprised of highly variable percentages of air and water that are subjected to great fluctuations (see Figure 19).

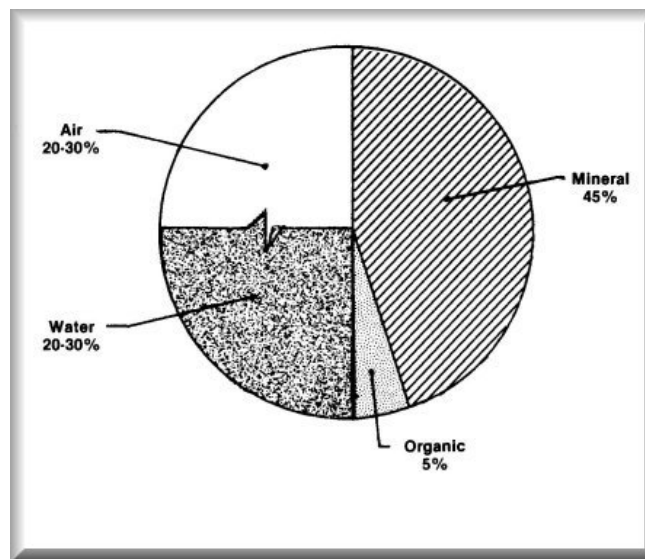


Figure 19. *Components of Soil*

The mineral soil fraction is comprised of rock fragments and minerals which depend upon the type of material from which it was derived and the weathering environment. The organic portion is comprised of partially decayed and synthesized plant and animal residues. The soil solution contains small but significant amounts of dissolved solids; and is usually acidic in Maine due to biological activity and the type of vegetation.

Soil covers most of the land surface of Maine but it is highly variable both horizontally and vertically. The soils characteristics are influenced by the type of material from which it was derived (parent material), the climate, vegetation, topography, and age. Local variations in soil conditions are usually due to variation in parent material and natural drainage conditions which are related to its position in the landscape. Each soil has unique characteristics that make it possible to be identified and classified.

Individual soils are three-dimensional. They may be few inches or several feet thick and are usually comprised of several layers (or horizons). Each horizon is identified by a combination of properties including color, texture, structure and consistence (density/firmness). Soil conditions can be relatively similar for extensive areas and can also be quite variable within several feet. Because of the possibility for variation within a very small area, the Site Evaluator must excavate a sufficient number of observation pits to assure that the conditions observed are indicative of the total area under the proposed system.

SOIL PROFILES

Soils are described by digging observation pits at least 12" below the limiting factor or until refusal and observing the exposed soil profile that consist of soil horizons. Soil horizons are differentiated by variations in soil characteristics (i.e. texture, structure, color, etc.). Site Evaluators should be primarily concerned with soil characteristics that influence the suitability of soils for wastewater disposal; although it is valuable for Site Evaluators to be familiar with the terminology used for soil descriptions in more sophisticated classification systems such as the **Natural Resources Conservation Service, U.S.D.A., Soil Taxonomy**. Horizons in soil taxonomy are classified using the combination of capital letters, **O, A, E, B, C** and **R** along with lower case letters **a, e, g, h, i, m, p, r, s, w** and **x** as suffixes. All soil profiles have soil horizons; however, not all soil profiles will have all of the Master Horizons. Recent soils, which have not had time to fully develop and disturbed soils, are examples of soils that lack some of the Master Horizons.

Master Horizons

O Horizon: A layer of organic matter usually resting upon mineral soil. Soils found in a forest or bog environment commonly have a surface layer consisting of leaves, twigs, humus or other organic material.

A Horizon: A surface mineral soil horizon characterized by highly humified organic matter content intimately mixed with the mineral fraction. The A Horizon may develop from cultivation, pasturing, or similar kinds of disturbance. When cultivation, pasturing, or similar

kinds of activities have altered the A Horizon, it is called an Ap (A plowed) horizon. An Ap horizon commonly is a combination of the O, A, E and parts of the B Horizons.

E Horizon: A layer of maximum leaching (eluviations) of iron, aluminum, and organic matter. The E Horizon is usually lighter in color than the overlying or underlying horizons. An E Horizon is commonly found near the surface below an O or A Horizon and above a B Horizon. E Horizons are most commonly found in forested soils and are usually destroyed by cultivation. In cultivated or disturbed soils, the remnants of an E Horizon can be mistaken for low chroma (gray) mottles (spots or blotches different in shade or color from the soil predominant color that indicate periods of soil saturation).

B Horizon: The B Horizon generally forms directly below the E Horizon, when an E Horizon is present. In soils lacking E Horizon, the B Horizon forms below the O or A Horizon. In soils where an E Horizon is or has been present, this horizon is characterized as the horizon of maximum accumulation (illuviation) of iron, aluminum and organic matter. Dark reddish brown to a yellowish brown color may be evident in the more developed B Horizons. In soils where an E Horizon has not developed, the B Horizon is usually more weakly expressed and may only exhibit color or structure development. These B Horizons are much duller in color than those that are strongly illuviated.

C Horizon: The C Horizon consists of material from which the soil developed. It is typically un-weathered but may have been slightly modified by weathering.

R Horizon: This symbolizes solid bedrock.

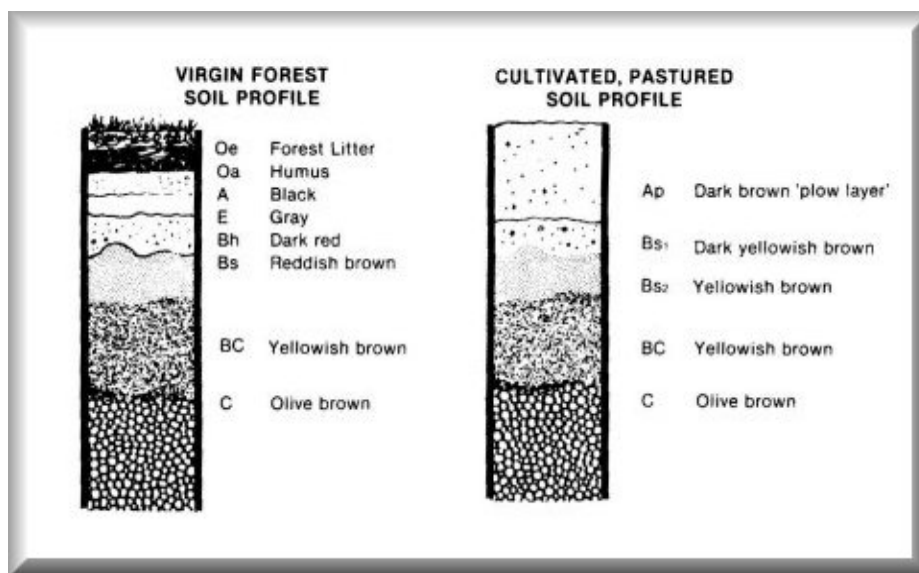


Figure 20. *Typical Soil Profiles*

SUBORDINATE DISTINCTIONS WITHIN MASTER HORIZONS

- a highly decomposed organic material. Symbol is used with **O**.
- c Concretions or hard nodules. Iron, aluminum concretions.
- d dense basal till usually associated with **C**.
- e Organic material of intermediate decomposition. This symbol is used with **O**.
- g Strong gleying. Indicates that iron has been reduced (oxygen removed) or that saturation with stagnant water has preserved a reduced environment. Gray and bluish gray colors prevail.
- h Illuvial accumulations or organic matter. This symbol is used with **B** to indicate accumulation of dispersible organic matter, and to lesser extent sesquioxide complexes (iron and aluminum compounds).
- i slightly decomposed organic matter. Symbol is used with **O**.
- m Cementation. Indicates continuous cementation where roots will not penetrate except through cracks. If iron is the predominant cementing agent “qm” is used.
- p Plowing or other similar disturbance. This symbol is used most commonly with **A**, but can be used with **O**. A disturbed mineral horizon, even though once and **E**, **B**, or **C** horizon is designated **Ap** if it is or once was at the surface and contained a high percentage of organic matter.
- r Weathered bedrock. This symbol is used with **C** to indicate weathered bedrock that can be dug with a spade.
- s Illuvial accumulation of iron aluminum and organic matter. This symbol is used with **B** and may also be combined with *h* as **Bhs**.
- w Development of color or structure. This symbol if used with **B** to indicate development of color or structure with little illuvial accumulation of material.
- x Fragipan character. Used to indicate a fragipan or fragipan like layer that may not be genetically developed, but is firm, brittle or of high density.

SOIL FORMATION

Soil formation in Maine has occurred since the last glacier retreated about 12,500 years ago. The major soil forming process resulting from weathering (interaction of climate, time, topography, vegetation and parent material) is podzolization. During podzolization, material is leached from the E Horizon and deposited in the B Horizon. The primary materials that are leached in Maine soils are iron, aluminum, and organic matter. The E Horizon, from which these materials were removed, consequently becomes grayish to whitish in color. The B Horizon, where these materials are deposited, subsequently becomes dark reddish brown to yellowish brown. Soils in which the podzolization process is not intense enough lack strong color horizonation. In extreme cases of podzolization, especially wet, sandy soils, the B Horizon may be black.

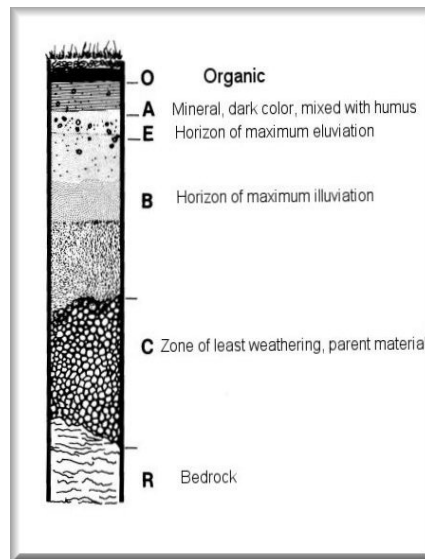


Figure 21: *Theoretical Soil Horizon*

SOIL TEXTURE

Soil texture refers to the relative proportions of the various size groups of individual soil grains in a mass of soil. Specifically it refers to the proportions of clay, silt, and sand that are the fine earth material less than 2 millimeters in diameter. These individually sized groups of mineral particles are commonly referred to as soil separates (see Table 1).

<u>Table 1. Soil Separates</u>	
<u>Name of Separate</u>	<u>Diameter (range) mm.</u>
Very coarse sand	2.00 – 1.00
Coarse sand	1.00 – 0.50
Medium sand	0.50 – 0.25
Fine sand	0.25 – 0.10
Very fine sand	0.10 – 0.05
Silt	0.05 – 0.002
Clay	less than 0.002

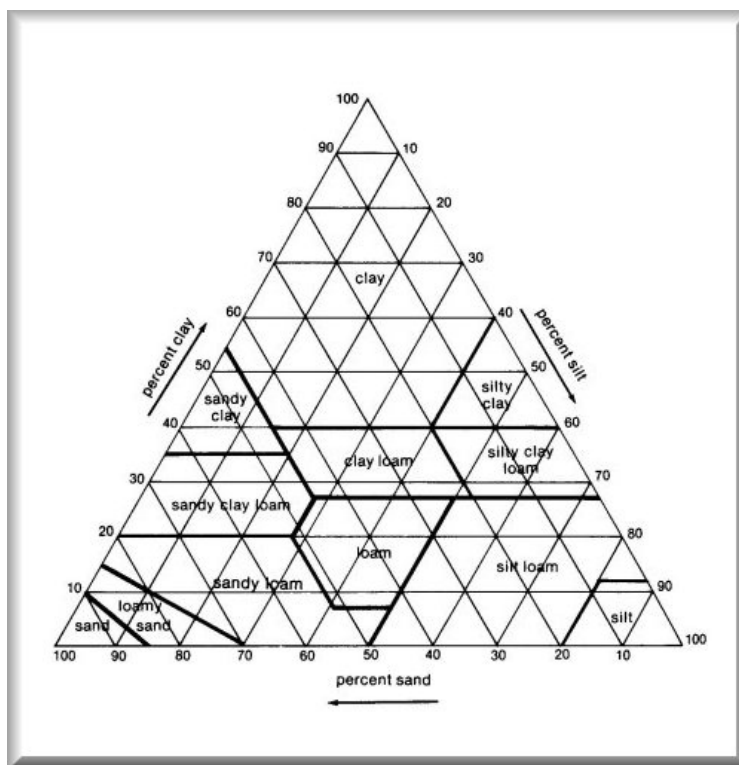


Figure 22. *Soil textural triangle*

Table 2. Feeling and appearance of various soil textural classes		
Soil Textural Class	Soil Moisture Content	
	Dry Soil	Moist Soil
Sand	Loose, single grains which feel gritty. Squeezed in the hand the soil mass falls apart when the pressure is released.	<i>Squeezed in the hand it forms a cast which crumbles when lightly touched.</i>
Loamy Sand	Loose, single grains which feel gritty but enough fine particles to stain finger prints in palm of hand.	<i>Squeezed in the hand it forms a cast which only bears very careful handling.</i>
Sandy Loam	Aggregates are easily crushed. Very faint, velvety feeling initially, but as rubbing is continued, the gritty feeling of sand soon dominates.	<i>Forms a cast which bears moderate handling without breaking. Doesn't form a ribbon between thumb and forefinger.</i>
Loam	Aggregates are crushed under moderate pressure; clods can be quite firm. When pulverized, loam has a velvety feel that becomes gritty with continued rubbing.	<i>Cast can be handled quite freely without breaking. Very slight tendency to ribbon between thumb and forefinger. Rubbed surface is rough.</i>

Silt Loam	Aggregates are firm but can be crushed under moderate pressure. Clods are firm to hard. Smooth, flour-like feel dominates when soil is pulverized.	<i>Cast can be freely handled without breaking. Slight tendency to ribbon between thumb and forefinger. Rubbed surface has a broken or rippled appearance.</i>
Silty Clay Loam	Aggregates are very firm. Clods are hard to very hard.	<i>Cast can be handled very firmly without breaking. Tendency to ribbon between thumb and forefinger with some flaking, greasy feeling, moderately sticky. Squeezed with proper moisture content into a long ribbon, sticky feel.</i>
<i>Silty Clay</i>	<i>Aggregates are extremely firm. Clods are very hard to extremely hard.</i>	<i>Cast can be handled extremely firmly without breaking. Extreme tendency to ribbon. Squeezed with proper moisture content into a very long ribbon, very sticky feel.</i>

Texture of a soil horizon is a nearly permanent characteristic and greatly influences infiltration, permeability, aeration, drainage, cation exchange capacity, fertility and many other characteristics. Soil texture is one of the primary characteristics considered when designing disposal systems due to the large influence of texture on the characteristics of a soil. Disposal of liquids into the soil from a disposal area is through soil pores, between soil aggregates and through root channels. That is why it is important not to smear or compact native soils into which effluent is to flow. Smearing cuts off pores, compaction eliminates them. The soil pores vary in size with soil texture. Soil texture, soil structure, moisture content, and root penetration also effect the liquid movement through the soil.

The size of the soil pores, which is a function of texture, influences the permeability rate that in turn determines the amount of wastewater the soil can absorb. Soils with very fine textures (silt and silty clay) usually absorb effluent only at a very slow rate, while sandy soils with coarse textures usually absorb larger quantities of effluent over the same period of time.

Rarely does soil consist completely of one separate. Classes of soil texture are based on different combinations of sand, silt and clay. The basic classes usually encountered in Maine in order of increasingly finer texture are: sand, loamy sand, sandy loam, loam, silt loam, silt, silty clay loam, and silty clay. The determination of soil class is made in the field during an on-site investigation by feeling and observing the soil. This requires skill and experience by the Site Evaluator. Table 2 describes the various feelings and appearance of the soil textural classes.

The *Maine Subsurface Wastewater Disposal Rules* utilizes the United States Department of Agriculture classification for size limits of soil separates. Table 1 lists the soil separates and diameter ranges. Significant proportions of fragments coarser than sand are recognized by an appropriate adjective **gravelly, stony, or cobbly** (see Table 3).

Table 3. Coarse fragments versus particle size diameter	
<u>Coarse Fragment</u>	<u>Size Diameter</u>
Gravel	up to 3"
Cobble	3" to 10"
Stones	more than 10"

When soil volume contains 15 to 35% coarse fragments, the coarse fragment adjective is incorporated with the textural name (i.e. *gravelly sandy loam*, *cobbly sandy loam*, etc.). When the coarse fragments make up to 35 to 60% of the soil volume, the word *very* is used as a modifier along with the coarse fragment and textural adjective terms (very gravelly sand loam, very cobbly loamy sand, etc.). When the soil contains 60 to 95% coarse fragments, the word *extremely* is used as a modifier of the textural term. When the volume of coarse fragments is about 95% or more, and there is too little fine earth to determine the textural class, the terms gravel, cobbles, stones are used in place of fine earth texture.

SOIL STRUCTURE

Soil structure is the natural organization of soil particles into units separated by surfaces of weakness. An individual natural unit is called a *ped*. Soil can have simple structure, compound structure, or no structure at all. Simple structure is structure comprised of one type of ped while compound structure exhibits large peds composed of smaller peds within. Several basic shapes of peds are recognizable in Maine soils (see Figure 23).

Shape	Description
Granular:	Approximately spherical peds
Blocky:	Block-like or polyhedral peds
Platy:	Peds are flat, plate-like and oriented horizontally
Prismatic:	Peds with flat or slightly rounded vertical faces. Longer vertically than horizontally. Tops of prisms are normally flat

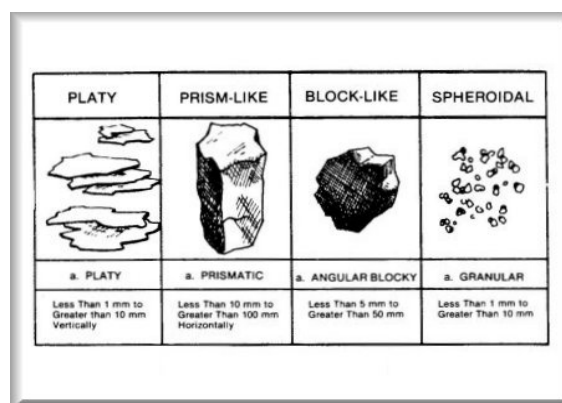
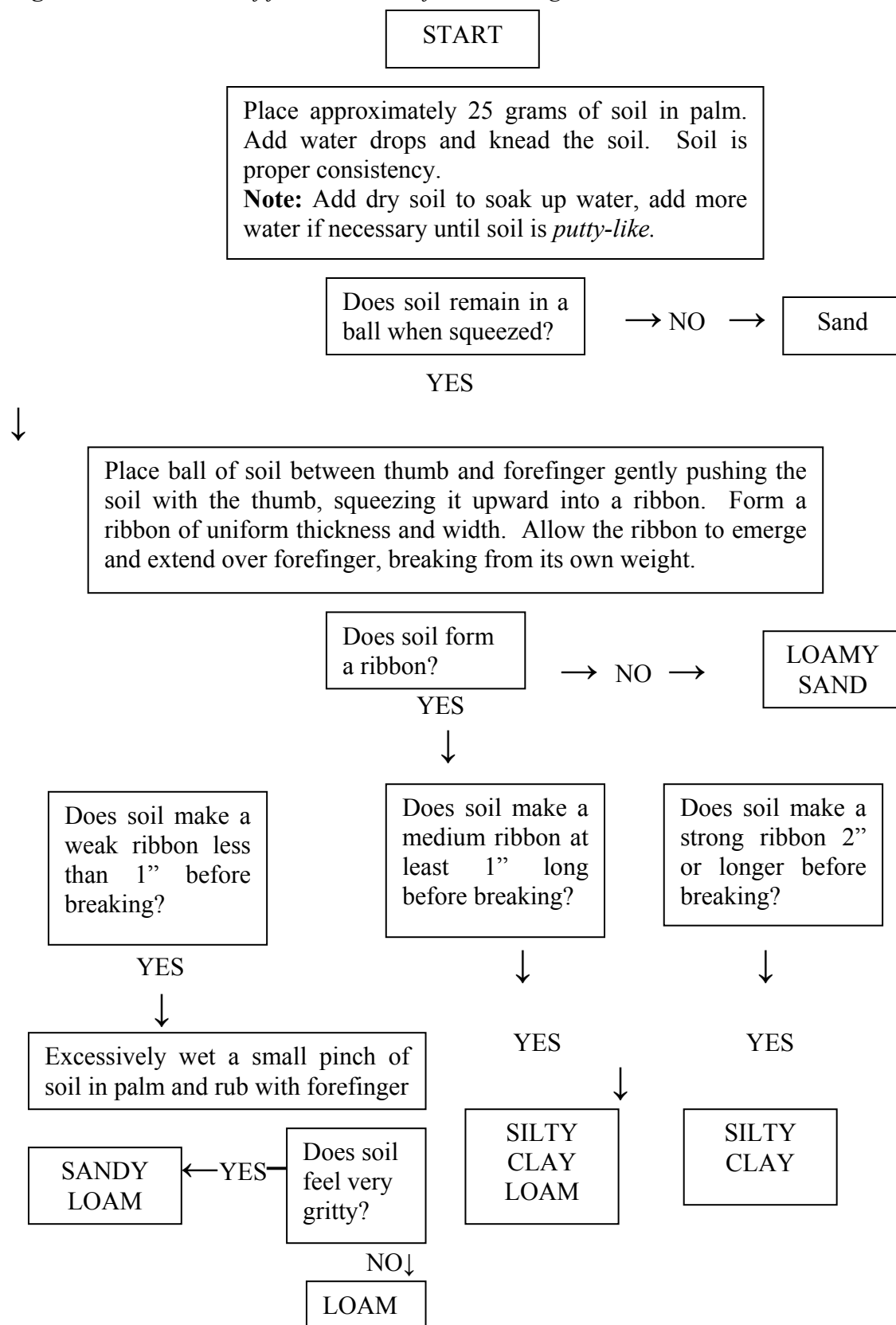


Figure 23: *Soil Structure*

Observation of soil structure is important in determining internal soil water movement for subsurface wastewater disposal design consideration. Granular structure is favorable to air and water movement in all directions and is usually found in upper soil horizons. Blocky structure allows for soil water movement in all directions, but commonly to a lesser degree than granular peds. Platy structure inhibits downward movement of soil water to various degrees and soil water movement is generally forced laterally. Platy structure is usually associated with a restrictive layer for subsurface wastewater disposal design consideration. Prismatic structure is usually associated with the finer textured soils. There is very little internal soil water movement within prisms so that soil water movement generally is restricted to channels between prism faces or perhaps laterally across the top of the peds.

Friable soil structure is a primary reason that certain soil textures are suitable for disposal system installation, but not for disposal area fill. Naturally occurring soils develop structure over time, but that structure is destroyed when the soil is excavated and remolded. Studies have shown that soil permeability can be significantly decreased when remolded. It is therefore necessary to use fill which has single grain structure, but which also has a small percentage of silt and clay sized particles (fines) to provide treatment for effluent.

Figure 24. Flow chart of field methods of determining soil textures.



SOIL CONSISTENCE

The cohesion among soil particles and adhesion to other substances is described by *soil consistence*. Soil consistence may be described in terms of soil strength, which is the degree of resistance to breaking or crushing when force is applied. When evaluated at field moisture capacity, the terms of loose, very friable, friable, firm, very firm, extremely firm, or cemented are used. All other things being equal, the firmer the soil, the less permeable it is to wastewater movement.

SOIL RESTRICTIVE LAYER

A restrictive layer is a horizon in the soil that is resistant to downward movement of water and root penetration, and a cause of perched water tables. Lateral movement of water over the layer is common on steep slopes. Restrictive layers may exhibit platy or prismatic structure and firm, very firm, extremely firm, or cemented consistence. Restrictive layers in Maine soils are found in firm basal till, fine textured sediments, or perhaps genetically formed in sandy loam or loamy sand horizons. Wet sandy soils can exhibit a restrictive layer from iron cementation. Soil science terminology refers to this as an *orstein* layer.

WASTEWATER MOVEMENT IN SOIL

The liquid movement from a disposal area into the surrounding soil is by gravitational (hydrostatic) pressure as well as capillary or matrix tension. Coarse textured soils (sands or loamy sands) rely on the large pores for water movement and are primarily influenced by gravity pressure. Finer textured soils (silt loams, silts, silty clay loams) mostly depend on the smaller capillary pores for water movement. In small pores, capillary attraction tends to retard the pull of gravity and slow the percolation rate. Only in the larger soil pores does the water move with any degree of speed.

Soil permeability rates are subject to change with an application of wastewater over time. Wastewater application tends to promote an organic mat development at the interface of the outer surface of the disposal area and the surrounding soil media. Higher wastewater loading application (both in volume and quality) tend to promote higher organic mat development within a given soil type. Although there are some generalities regarding soil permeability rates and wastewater loading applications, there are significant variations between soil textural classes. Research has shown that soils generally have a higher permeability rate when exposed to clean water, resulting in little or no mat development. However, after an organic mat develops, which occurs when wastewater is applied, soil permeability rate decreases. Interestingly, the decrease in soil permeability rates, after being exposed to wastewater applications, is greater in coarse textured soils (i.e. sands & gravels) than it is in finer textured soils (silts and clays). This is because sands and gravels transmit water through gravity pores and generally do not have capillary pores. When a mat forms, water moves through it by capillary pores until it reaches the gravity pores of surrounding sand or gravel. Lack of matrix tension in the gravity pores creates a barrier to water movement. Finer textural soils do not offer such a barrier as they have both capillary and gravity pores.

SOIL PARENT MATERIAL

Parent material is the physical body of soil and its associated chemical and mineralogical properties at the starting point of soil formation. It is also the basis for the development of classification systems in the *Subsurface Wastewater Disposal Rules* (see Table 4) that recognizes 12 soil profiles. It is very helpful to have an understanding of the local surficial geology and glacial processes to assist in identification of parent materials.

There are 6 major types of parent material found in Maine.

Glacial Deposits

Glacial Till:

Material deposited directly by the glacial ice mass is called glacial till. It is the oldest and one of the most widespread surficial materials in Maine. Till generally overlies bedrock. Glacial till deposits in Maine are comprised of sediments of textural classes ranging from silt loam, loam, sandy loam, and loamy sand. Angular coarse fragments of gravel, cobbles, or stones are common (see Figures 21 and 22). Generally there is no evidence of stratification due to sorting by water flow. Till may contain thin, discontinuous beds of washed sediments, but pronounced bedding is rare. Large stones may be present at the surface or within the profile.

There are two basic subcategories of glacial till; **basal till** and **ablation till**. Basal till was laid down at the bottom of a glacier. It ranges in texture from loamy sand to silty clay loam, is compact, and difficult to excavate. This kind of till is often called *hardpan*. Ablation till was deposited by the settling of particles from melting glacial ice. It is loose, sandy and easy to excavate. Ablation till may grade locally into stratified drift material. Stone fragments in basal till are primarily angular, where as stones in ablation till are commonly both angular and rounded.

Stratified Drift Deposits

Glacial meltwater streams from the last glacier laid down stratified drift deposits. These deposits can be classified into two categories: 1) ice contact stratified drift and 2) proglacial outwash. Ice contact stratified drift includes kames, kame terraces, eskers and deltas. Proglacial outwash includes only outwash plains (see Table 5).

Table 4. Parent Materials in Maine
Glacial Deposits
Glacial Till (Non-Stratified Glacial drift): Basal till, ablation till
Stratified Glacial Drift: ice contact stratified drift, Kames, eskers, kame terraces, proglacial outwash

Water Deposits
<p>Marine: ocean deposit</p> <p>Lacustrine: lake sediment</p> <p>Alluvial: river, stream deposit</p>
Organic
Organic: peat bog, marsh, swap



Figure 25. *Valley glacier illustrating sediment deposited directly by ice (end moraine in foreground) (Photo by G. Denton)*

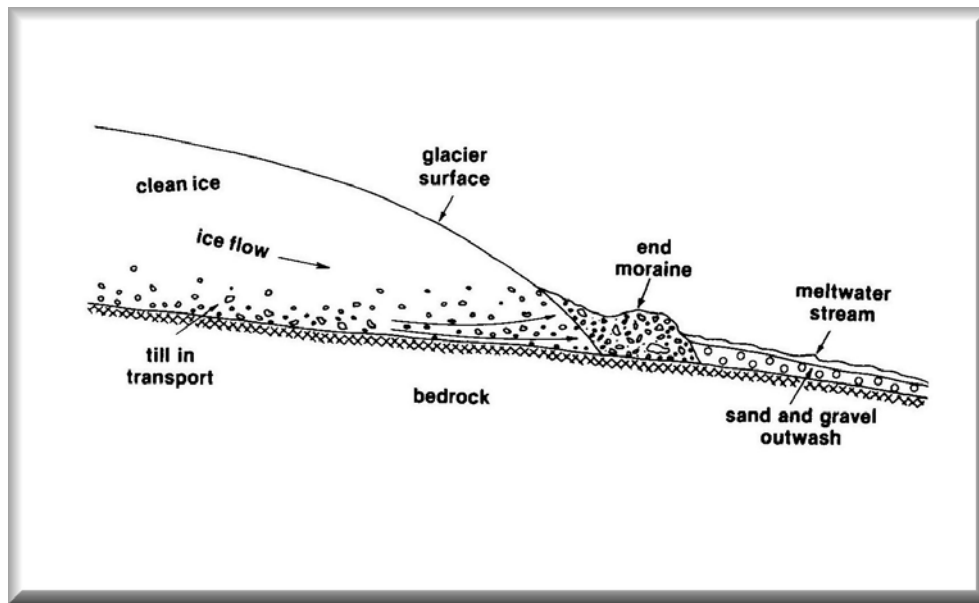


Figure 26. Cross-section of the margin of a glacier (Thompson, 1978)

Table 5. Stratified Drift Deposits Depositional Environment	
ICE CONTACT STRATIFIED DRIFT DEPOSITS	
Kame	Randomly deposited on, within, beneath, or adjacent to melting glacial ice.
Kame terrace	Usually deposited between stagnant ice and a nearby valley-wall; upper surface was graded by streams and is flatter than a kame.
Esker	Deposited in a tunnel within or beneath stagnant ice.
Delta	Built into a lake or the ocean; may have formed in contact with glacial ice or at the end of an esker, hence the varieties "kame delta" and esker
PROGLACIAL OUTWASH DEPOSITS	
Outwash Plain	Formed beyond the margin of the glacier and may terminate in a delta if the meltwater stream entered standing water.

Each type of stratified drift deposit has unique characteristics and composition. However, all of the stratified drift deposits will exhibit some degree of stratification. Stratification is alternating layers of different, but well sorted particles (see Figure 27). They range in textural classification from fine sand to gravel, and may have a finer textured cap. Rock fragments are typically rounded.

Marine Deposits

Material deposited on an ocean floor is referred to as marine sediment. Fine sediment washed out of the glacier that covered Maine during the *Ice Age* (Pleistocene), and accumulated on the ocean floor. The ocean, during that period, extended inland along the major river valleys. Marine deposits are found over 300 feet above present sea level in parts of Maine (see Figure 29).

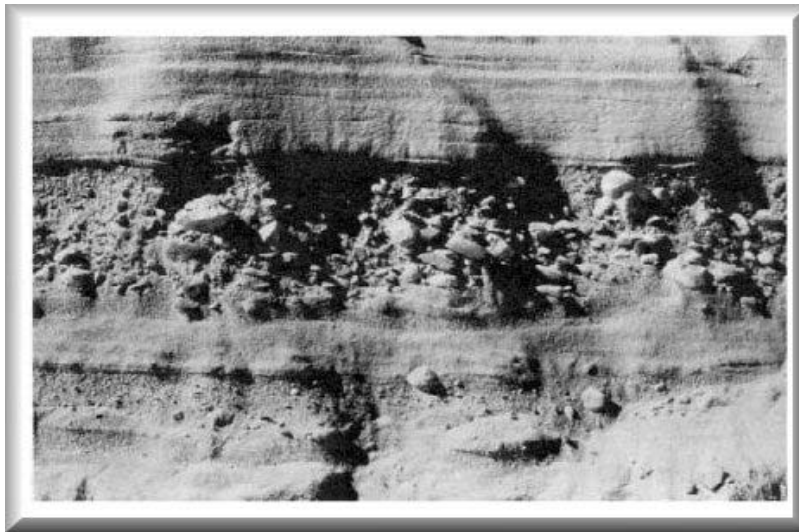


Figure 27: *Stratified drift deposit (Photo by A. Frick)*



Figure 28: *Recent sediment deposited in marine environment (photo by A. Frick)*

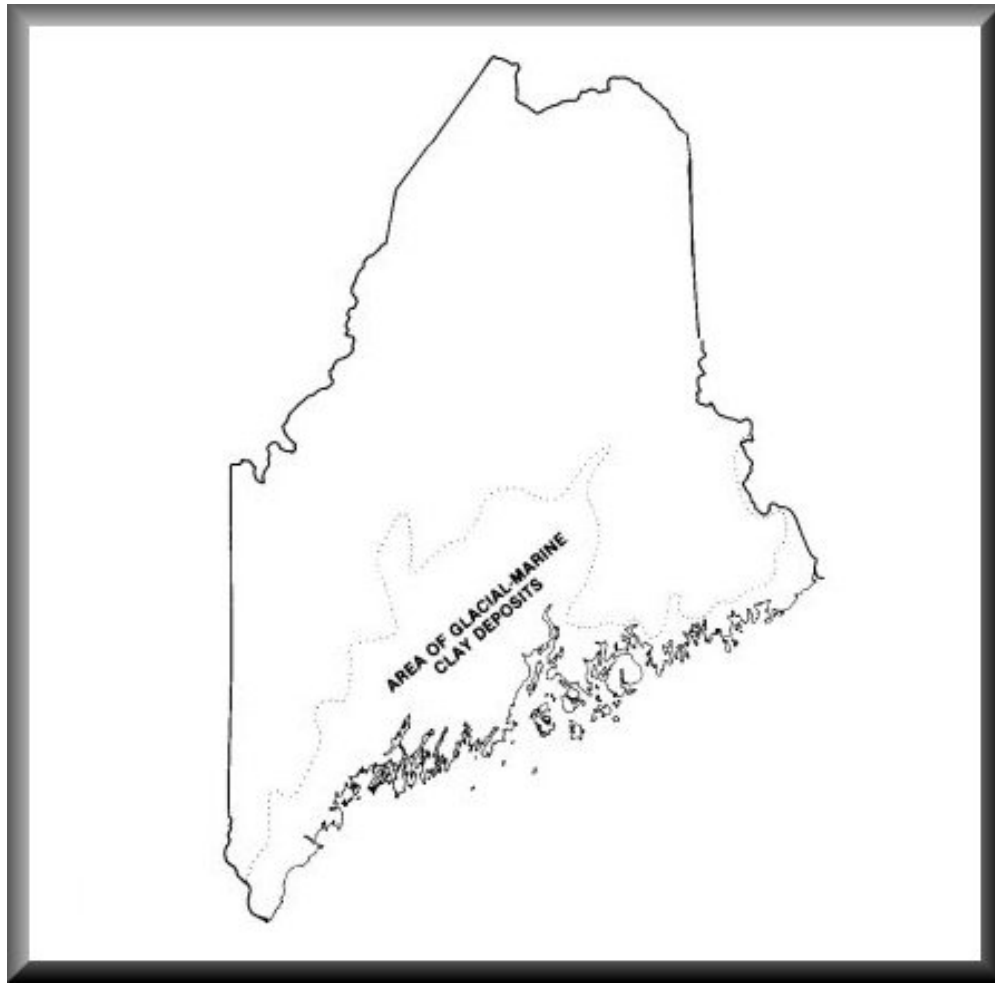


Figure 29: *Extent of Glacial-marine clay in Maine (Thompson, 1978)*

Terrain underlain by marine sediment is usually gently sloping. Marine sediments are often called *clay* but the correct textural class is usually silt loam, silty clay loam, or silty clay. These types of deposits usually become firm and dense with increasing soil depth (see Figure 30). Rock fragments are usually absent.

Lacustrine Deposits

Lacustrine deposits were laid down in lake bodies. The soil textures of lacustrine sediments are usually slightly coarser than marine sediments and they may exhibit thin horizons (lenses) of fine sand to sandy loam material in the substratum. Rock fragments are usually absent.

Alluvial Deposits

Recent water-deposited sediments found on flood plain, terraces along modern rivers, and beaches are called alluvial deposits. These are young soils with very little soil horizonation and are primarily comprised of fine sands and silts.



Figure 30. *Profile of soil derived from marine sediment. Silt loam layer overlying silty clay loam and silty clay. (Photo by A. Frick)*

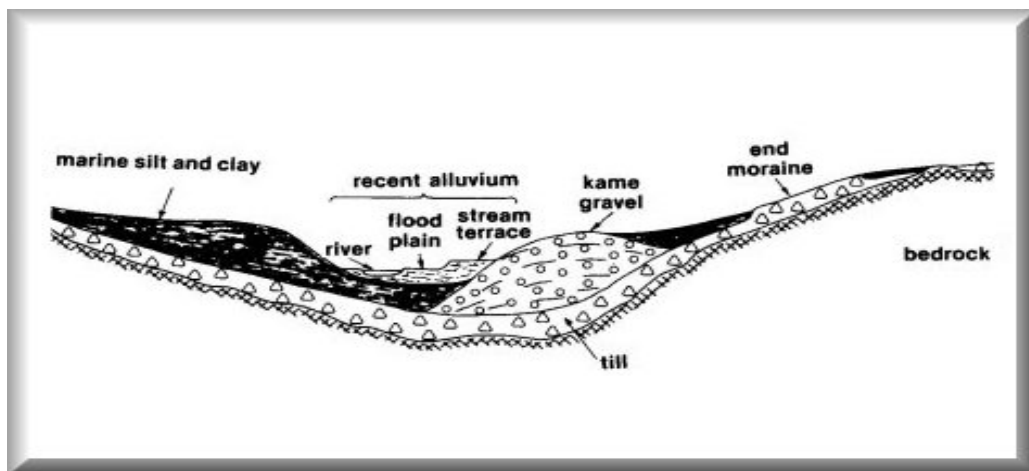


Figure 31. *Cross-section showing relationships among surficial deposits generalized (Thompson, 1978).*

Organic Deposits

Soils comprised primarily of organic matter are usually found in swamps, bogs and marshes. To classify as organic soils, the surface organic layer must be at least 16" deep, but may be underlain by mineral soils below that depth. Occasionally, organic soils can be developed due to cold climates and not as a result of saturation.

SOIL COLOR

Observations of soil color are very useful because many important inferences can be made from soil color and patterns. Mineralogy, wetness, organic matter content, and genetic processes influence soil color. Soil color does not have any known influence on the functioning of soil other than affecting absorption of heat at the soil surface. However, color is extremely important in providing clues toward understanding other physical, chemical, and biological soil properties.



Figure 32. *Munsell Soil Color Chart*

Commonly, dark colors in upper soil horizons suggest higher organic matter content than lighter colored soil horizons. Organic matter tends to build up in soils which have frequent organic matter additions (manure or other soil amendments added) or where microbial activity is reduced. In Maine, microbial activity is controlled by two factors: temperature and presence or lack of oxygen. When soil temperatures are below biologic zero (41° F) or soil oxygen is lacking, microbial activity is reduced or ceases. Very dark soil surfaces with soil drainage mottles or gray color just below the surface horizons may indicate poor drainage. **Note:** The *Maine Association of Professional Soil Scientists Soil Drainage Key* is a useful tool when attempting to determine the soil drainage class of soils with thick, dark surface horizons (see Appendix A).

The **Munsell Soil Color Chart** is a tool used to assist in determining the soil color (see Figure 32). Soil color is measured by comparison with approximately 200 different color chips systematically arranged according to their Munsell notation of hue, value and chroma. Hue is the dominant spectral color (wavelength of light). Value is the amount of light (lightness of color). Chroma is the strength of the color and increases with decreasing grayness. A light brownish gray color, for example, is denoted as 2.5Y 6/2 meaning that the color is of a 2.5Y hue, value of 6 and a chroma of 2. Munsell Color designation is not required for site evaluation reports. Objective description is acceptable however it is a very valuable tool for Site Evaluators. Becoming familiar with specific soil color designations is very helpful when

inferring conditions of soil wetness. For more information on use of Munsell Charts, see the publication *Maine Wetlands and Their Boundaries* listed in the bibliography.

SEASONAL WATER TABLE

Knowledge of the times and depths at which a soil is saturated, generally referred to as the seasonal water table, is very important in evaluating soil suitability for subsurface wastewater disposal. The lack of oxygen is very influential on the biological, chemical, and physical processes that take place in soils. The metabolic rate of aerobic bacteria is approximately seven times faster than anaerobic bacteria, hence organic decomposition is more rapid in an environment with oxygen (unsaturated) than one without oxygen (saturated).

Soil characteristics, climate, slope and landscape position influence soil saturation. Precipitation, runoff, infiltration, and permeability also affect the degree and duration of saturation. A soil at a higher elevation may have a lower water table or have a shorter duration of saturation than the same soil at a lower elevation downslope. Although the depth to groundwater table changes greatly during and between years, most soils usually have typical times and depths of saturation.

The most commonly used method to determine depth to the seasonal water table is the observation of soil morphological features. A skilled observer can infer much about soil saturation from soil color, texture, structure, consistence, and profile development. The observer must beware, however, of problem soils, and the fact that morphological features associated with soil saturation only develop when the soil temperature is above biological zero, 41° F, and the groundwater table is stagnant. (See Chapter VII, *Special Considerations*, Problem Soils).

SOIL DRAINAGE CLASSES

Soil drainage refers to the condition of soil saturation that exists in a soil and the frequency and duration of the periods of saturation. There are seven drainage classes recognized by the USDA Classification System, which are listed below in increasing order of saturation, duration, and frequency.

Excessively drained:

Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, stony, or very shallow (less than 10"). Some are steep. All are free of soil morphological features associated with saturation.

Somewhat Excessively Drained:

Water is removed from the soil rapidly and the soils do not have a seasonal water table within 40 inches of the mineral soil surface. Somewhat excessively drained soils are similar to excessively drained soils in texture except that they have a thicker cap, if greater than 40" to bedrock, if shallow (between 10" and 20" deep); they are deeper than excessively drained soils.

Well drained:

Water is removed from the soil readily but not rapidly. Water is available to plants throughout most of the growing season. Wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of soil morphological features associated with saturation, within the upper 40”.

Moderately well drained:

Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season. They commonly have a slowly permeable layer within the substratum periodically receive high amounts of rainfall, or runoff or a combination of these.

Somewhat poorly drained:

Water is removed slowly, and the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of some plants unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly permeable layer, a high water table, additional water from seepage or a combination of these.

Poorly drained:

Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Ground water is commonly at or near the surface for a long enough period during the growing season that most plants cannot be grown unless the soil is artificially drained. Poor drainage results from a high water table, a slowly permeable layer within the profile, seepage or a combination of these.

Very poorly drained:

Water is removed from the soil so slowly that ground water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most plants cannot grow. Very poorly drained soils are found in level or depressed areas and they are frequently ponded.

SOIL DRAINAGE MOTTLES (REDOXIMORPHIC FEATURES)

Iron is one of the main coloring substances of soil. The color of the iron in soil is closely related to the amount of oxygen that is present. Air is absent or in short supply when soils become saturated or nearly saturated with water. When air is absent in the soil, iron exists in a ferrous or reduced state. This causes the soil to be gray in color. When there is an air supply as in well-drained soils, the iron is in a ferric or oxidized state. This causes the soil to be yellowish or reddish in color. If, over a long period of time, a soil has been alternately wet and dry, combinations of both ferric and ferrous iron are found. This produces a mottled condition. Mottles that result from soil saturation are types of redoximorphic features.

Mottling is defined as spots or blotches of different color, or shades of color, interspersed with a dominant background (**matrix**) color. A seasonally fluctuating water table or intermittently perched water table, when the soil temperature is above biologic zero, usually results in the formation of brightly colored oxidized spots. These spots are called **high chroma mottles** or **redox concentrations**. Oxidation (bright colors) and reduction (dull colors) are caused by alternating aerobic and anaerobic conditions attributable to a seasonally fluctuating groundwater table, or the intermittent presence of a perched water table. Not all mottling, however, forms as a result of soil saturation. Mottles can occur by soil cultivation, mixing by animals, and tree throws. These mottles are not redoximorphic features (drainage mottles) because they are not formed by a combination of reducing and oxidizing conditions in the soil. Other types of redoximorphic features are less common and include oxidized rhizospheres, organic streaking, concretions (cemented modules), and their dark Bhs horizons. They are usually found in sandy and/or oxygenated soils that are saturated.

Mottles (redox concentrations and/or redox depletions) can be described in terms of **quantity** and **contrast**. Quantity can be classified as **few**, **common**, or **many**, based upon the percentage of the observed surface that is occupied by mottles (see Table 6). Contrast can be described as **faint**, **distinct**, or **prominent** based upon the visual distraction that is evident between associated colors.

Table 6. Mottles, Description	
QUANTITY % of Mottling	
Few	Less than 2%
Common	2 to 20%
Many	More than 20 %
CONTRAST Visual Distinction	
Faint	Evident only on close examination
Distinct	Readily seen, but contrasts
Prominent	Contrasts strongly with the soil matrix background color.

Following are the major soil drainage classes used in the *Subsurface Wastewater Disposal Rules*. The different drainage classes are based upon depth to and duration of groundwater tables.

Soil Drainage Class B (Well drained)

Drainage Class B soils usually have brighter colored subsoil and are free of drainage mottling to depths greater than 48". This indicates that water drains freely from the profile. Surface soil colors vary widely but are generally less dark than those of poorly drained soils.

Soil Drainage Class C (Moderately well drained)

Drainage Class C soils exhibit drainage mottling at 15 to less than 48 inches beneath the mineral soil surface. Water is removed from these soils somewhat slowly; the lower part of the profile is saturated for a short but significant part of the year. Drainage Class C soils commonly have a restrictive layer, seepage water, or a seasonally high groundwater table at a soil depth of 25 to 48 inches. Colors of the surface and upper subsoil are relatively uniform within each layer. Mottling becomes noticeable in the lower subsoil and may appear as yellow orange and/or gray spots and blotches mixed with the natural brownish color.

Soil Drainage Class D (Somewhat Poorly Drained)

Drainage Class D soils have a seasonally high groundwater table at less than 15 inches to 7 inches beneath the mineral soil surface. They generally do not have brightly colored subsoil. Typically, Drainage Class D soils have darker colored surface horizons than Drainage Class B or C. They usually occur at the lower end of long slopes and may be adjacent to low depressional areas. If these soils have been cultivated, the plow layer will have disturbed soil horizons to a typical depth of 8" to 10". Evaluation of the seasonal high groundwater table when mottling extends to the base of the plow layer will require an evaluation of the color of the plow layer and organic matter accumulation. The *Maine Association of Professional Soil Scientists Soil Drainage Key* is a very useful reference for making such determinations (see Appendix A).

Soil Drainage Class E (Poorly and Very Poorly Drained)

Drainage Class E soils have a seasonal or permanent water table at less than 7" below the mineral soil surface. These soils usually occur at the base of long slopes, in low depressions and at or near flat seepage areas. Condition E soils typically have dark colored surface horizons and may be dark throughout from organic matter accumulations. Gray colored subsoils are generally found at the base of dark colored surface horizons. Evaluation of the seasonally high groundwater table often requires an evaluation of the surface horizon color and organic matter content, which may mask drainage mottles. The *Maine Association of Professional Soil Scientists Soil Drainage Key* is a very useful reference for determining soil drainage class of these soils.

POSITION IN LANDSCAPE AND SOIL CHARACTERISTICS AFFECTING DRAINAGE

The drainage of a soil depends upon how much of the water falling on the land enters the soil and how quickly it passes through the soil. The position of the soil in the landscape, slope and size of the upslope watershed all influence drainage (see Figure 33).

Flat land and depressional areas have very little runoff and may receive additional runoff from higher ground; most of which must drain through the soil. Poorer drained soils generally occur in these positions. Undulating or rolling land has more runoff and less water passing through the

soil. Soils on upland knolls or on a side slope with a very limited watershed are usually well or moderately well drained, unless there is a restrictive layer perching the groundwater. Excessively drained soils occur on steep slopes where most of the water runs off and relatively small amounts of water enter the soil.

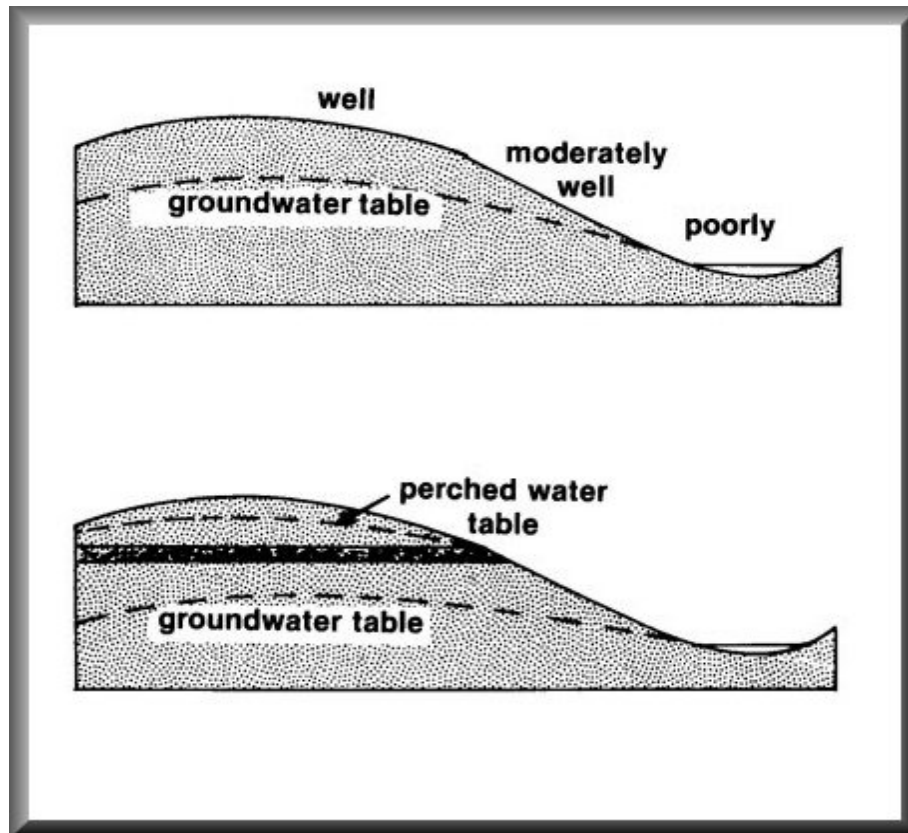


Figure 33: *Soil drainage and groundwater table*

Texture of the soil also influences the natural drainage. Coarse textured soils usually drain better than fine textured soils. Fragipans, claypans and bedrock all influence the natural drainage because they restrict the downward movement of water (see Figure 34).

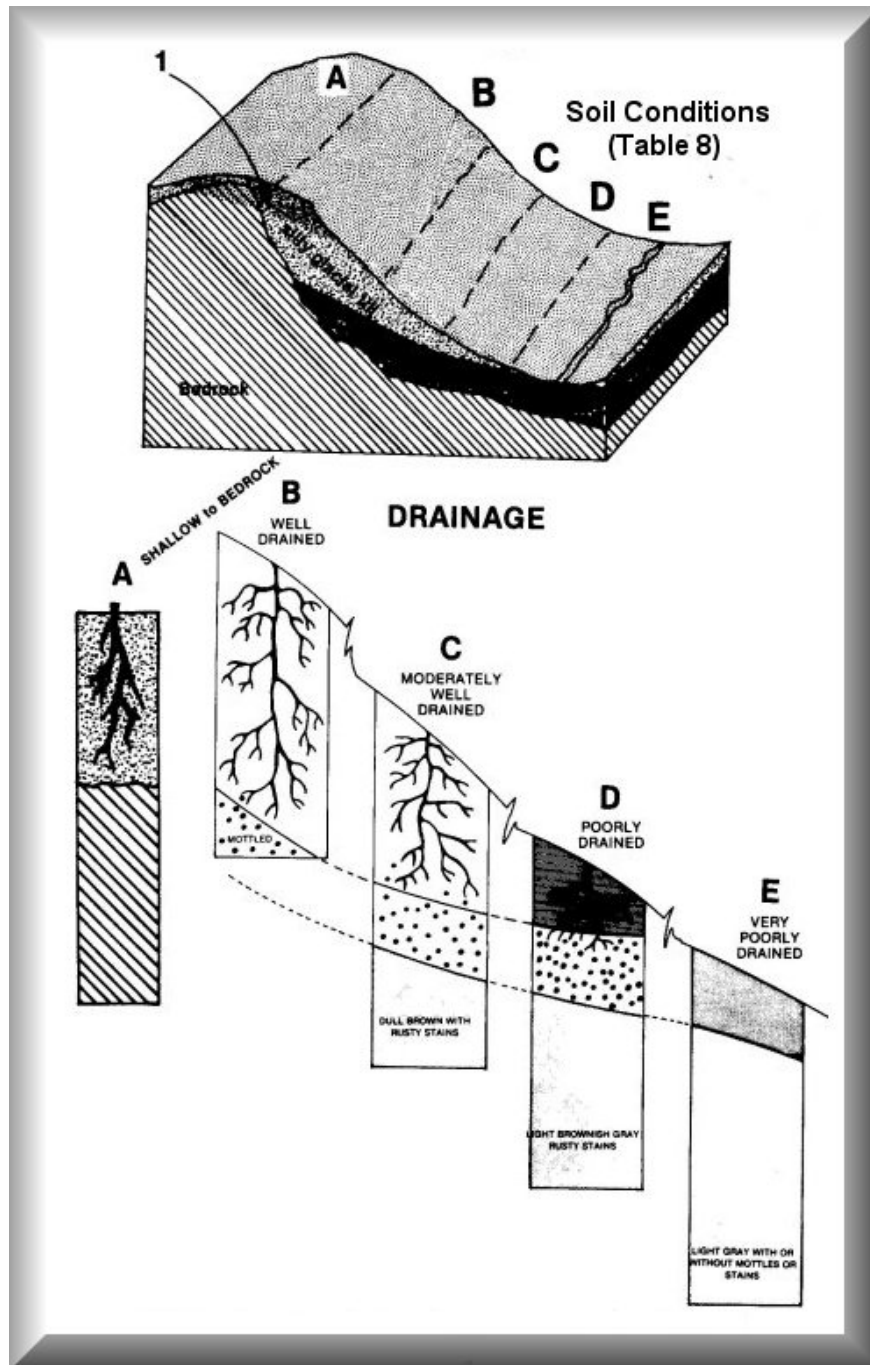


Figure 34. *Natural drainage classes of soil and subsurface wastewater disposal classifications*

CLASSIFICATION OF SOILS

A Site Evaluator must have the ability to recognize and describe parent materials, soil textures, consistency, soil colors, soil structure, drainage mottling (redoximorphic features), and restrictive layer. Soil characteristics that are pertinent to the design of systems have been incorporated into the Classification System of the Rules (see Table 7).

A Site Evaluator examines the soil texture (percentages of the various soil separates) throughout the profile and observes the coarse fragments, shape of particles, soil structure, consistency and horizonations. Knowledge of the characteristics of parent material coupled with the ability to identify texture will enable the Site Evaluator to classify the soil. Examination of the root depth, organic matter accumulation, soil structure, consistency, color, and drainage mottling (redoximorphic features) are the soil characteristics that are considered when identifying soil drainage, reflected in the vertical columns of Table 7 of the *Subsurface Wastewater Disposal Rules* (see Figure 34 and Table 7).

SOIL PROFILE AND DESIGN CLASS			DESIGN CLASS to be used with Table "Minimum Permitting Conditions and Design Requirements"								Disposal Area Sizing	
			Bedrock class			Soil drainage class					Multiply the hydraulic loading rate (square feet per gallon per day) times the design flow (gallons per day). This gives the minimum square feet of bottom and side wall area below the invert needed for a standard stone filled disposal field. Proprietary devices may be used in lieu of stone filled fields. See Appendix P.	
			AI	AII	AIII	B	C	D	E			
Parent Material	Soil Profile	Textural Classification and description	Inches from ground surface to the mineral soil to bedrock			Inches from the surface of the mineral soil to seasonal high ground water table or hydraulically restrictive horizon when molting is not present						
			0-12	12-15	15-48	> 48	48-15	<15-7	<7-0			
Basal Glacial Till	1	Silt loam textured soils throughout the entire profile. The lower horizons usually have prismatic or platy structures. This profile tends to become firm dense and impervious with depth thus this profile may have a hydraulically restrictive horizon. Angular rock fragments are usually present. Occasionally cobbles and stones maybe present	5	4	1	1	1	3	5	4.10 sqft/gpd Large		
Ablation Till	2	Loam to sandy loam textured soils throughout the entire profile. This profile does not have a hydraulically restrictive horizon. Angular rock fragments are present. Occasionally cobbles and stones maybe present	5	4	1	1	1	3	5	3.30 sqft/gpd Medium Large		
Basal Glacial Till	3	Loam to loamy sand textured soils throughout the entire profile. The lower soil horizons usually have well defined prismatic or platy structures that are very compact and are difficult to excavate. These lower horizons are considered hydraulically restrictive. Angular rock fragments are present. Occasionally cobbles and stones are present	5	4	1	1	1	3	5	3.30 sqft/gpd Medium Large		
Ablation Till	4	Sandy loam to loamy sand textured upper horizon(s) overlying loamy sand textured lower horizon. This profile tends to be loose and easy to excavate. Lower horizons tend not to be firm and are not considered hydraulically restrictive. Angular rock fragments are present along with partially water-worn cobbles and stones	5	4	1	1	1	3	5	2.60 ft ² /gpd Medium		
Stratified Glacial Drift	5	Loam to loamy sand textured upper horizons overlying fine and medium sand parent materials. Stratified horizons of water-sorted materials may be present. Lower horizons tend to be granular or massive. Entire profile tends to be loose except that saturated horizons may be cemented and therefore firm and are considered hydraulically restrictive. Horizons with rounded rock fragments are common	5	4	2	2	2	3	5	2.60 ft ² /gpd Medium		
	6	Loamy sand to sand textured upper horizons overlying stratified coarse sands or gravel parent materials. Stratified horizons of water-sorted materials maybe present. Entire profile tends to be loose except that saturated horizons may be cemented and therefore firm and are considered hydraulically restrictive. Horizons with rounded rock fragments are common.	5	4	2	2	2	3	5	2.00 ft ² /gpd Small		
Mixed geological origins	7	Fifteen (15) or more inches of sandy loam to loamy sand glacial till or loamy sand to sand stratified drift parent material overlying marine or lacustrine deposited silt to silty clay or fifteen (15) or more inches of loamy sand to sand stratified drift parent material overlying firm basal till. The upper horizons tend to be granular in structure. The lower horizons tend to be firm and massive in structure and are considered to be hydraulically restrictive. Rock fragments may be present in upper horizons but are usually absent in lower horizons, except for basal till.	5	4	1	1	1	3	5	3.30 ft ² /gpd Medium Large		
Lacustrine deposits	8	Loam to fine sandy loam upper horizon(s) overlying firm silt loam to silt textured lower horizons. The upper horizons tend to be granular in structure. The lower horizons tend to be firm and massive in structure and are considered to be hydraulically restrictive. Stratified lenses of fine sand and sandy loam may be present in the lower horizons. Coarse rocks are usually absent throughout entire profile.	5	4	1	1	1	3	5	4.10 ft ² /gpd Large		
Marine deposits	9	Silt loam textured upper horizons overlying firm silt loam to silty clay textured lower horizons. The lower horizons tend to be very firm and are considered to be hydraulically restrictive. Coarse rock are usually absent throughout entire profile. Thin lenses of very fine sand to silt may be present in the lower horizons.	5	4	1	1	1	3	5	5.00 ft ² /gpd Extra Large		
Organic deposits	10	Partially decomposed organic material.	5								Use the Soil Profile Bedrock Class Soil drainage Class and minimum hydraulic loading rate that best describes the observed profile.	
Alluvial dune beach deposits	11	These soils have no typical profile. Variable in texture and exhibit very little weathering. They are deposited in flood plains sand dunes or beach environments.										
Filled Site	12	These soils have no typical profile. Variable in texture. May contain man-made materials.										
			Use the Soil Profile Bedrock Class Soil drainage Class and minimum hydraulic loading rate that best describes the observed profile. For first time and non-exempt expansion systems see Section 605.0 and Appendix J.									

Table 7

The size rating and design criteria to properly treat the wastewater is determined after the Site Evaluator classifies the soil profile and conditions in accordance with the Rules.

Soil Profile Classification

Profile 1 soil is derived from a fine grained glacial till parent material. The soil textures are commonly silt and silt loam but can also range from fine sandy loam to gravelly clay loam with the finer textures generally found in the lower soil horizons. Angular coarse fragments are typically found throughout the profile. Profile 1 soils are distinguished from Profile 8 and 9 soils by the presence of coarse fragments derived from glacial deposition. Profile 1 soils typically become restrictive with depth but are occasionally friable throughout. Stones and cobbles may be present.

Profile 2 soil is derived from a medium grained glacial till which is friable throughout the profile. Soil textures generally range from loam to sandy loam but may also include lenses or pockets of loamy sand to sand. Angular coarse fragments are typically found throughout the profile. Stones and cobbles may be present.

Profile 3 soil is similar to Profile 2 in both parent material and soil texture; however Profile 3 soil has a hydraulically restrictive horizon which Profile 2 lacks. Profile 3 soils are derived from basal glacial till which causes the firm substratum. Angular coarse fragments are typically found throughout the profile. Stones and cobbles may be present.

Profile 4 soil is derived from ablation till and soil textures typically range from loamy sand to sandy loam in the upper soil horizons overlying loamy sand subhorizons. Because they are glacial till soils, they usually have coarse fragments throughout the profile. However, both angular and rounded coarse fragments can be found, suggesting some water action. These soils are loose to friable throughout with no hydraulically restrictive horizon being found.

Profile 5 soil is derived from glacial outwash or stratified drift parent material and can be distinguished from soils derived from glacial till soils by the evidence of water sorting. This soil typically has loamy sand to sandy loam topsoil horizon which overlies fine to medium sand subhorizons. The sandy subhorizons may exhibit stratification and commonly have coarse fragments that are primarily rounded. Water sorting has generally removed the silt and clay sized particles from the subhorizon layers. These soils generally do not have a restrictive layer. Profile 5 soils occasionally have cemented layers (orstein) from the lateral and vertical movement and precipitation of iron, aluminum, and organic matter. These cemented layers can become so restrictive that they create a perched water table above them. Large stones are generally not found in Profile 5 soils; however, rounded cobbles may be present.

Profile 6 soil is derived from glacial outwash or stratified drift parent material (similar to Profile 5 soils) but has a coarser textured subhorizon. The soil textures typically are loamy sand in the upper horizon overlying coarse sand or gravel subhorizons and are the coarsest soil profile recognized by the Rules. Coarse fragments are usually found and

they are nearly always rounded due to water action. They can also have cemented layers, similar to Profile 5.

Profile 7 soil is a mixed origin parent material soil. It is typically loamy sand to sandy loam glacial till or loamy sand to sand outwash material over marine or lacustrine sediment; but can also be loamy sand to sand outwash material overlying firm, basal till subsoil. A minimum of 15 inches of the coarser textured soil must be present for the soil to classify as a Profile 7. A restrictive layer is present in the lower horizons. There are coarse fragments typically found in the upper soil horizon and in the subhorizons of the basal till.

Profile 8 soil is derived from lake (lacustrine) deposits. Soil texture typically ranges from loam to fine sandy loam surface horizons underlain by firmer silt to silt loam subhorizons. The subhorizons tend to be restrictive and may contain lenses or varves of fine sand to sandy loam. They are water sorted from a tranquil lake depositional setting that allowed fine soil particles to settle out of suspension. Occasionally, during high runoff periods, fine sand particles will be carried into the lake, causing a soil texture of very fine sand to silt. Coarse fragments are almost always absent, a distinguishing characteristic between Profile 1 and Profile 8 soils.

Profile 9 soil is derived from marine or estuary sediments. They are water sorted, in a similar fashion to Profile 8 soils. Profile 9 soils settled in a tranquil marine depositional setting that allowed for finer textured sediments to settle out. Typically, they consist of silt loam textured upper soil horizons overlying firmer silt loam to silty clay loam subsoils. Coarse fragments are generally absent throughout the profile. Profile 9 description does allow for the subhorizon to contain thin lenses of very fine sand to silt. Subhorizons tend to be firm and restrictive. The primary difference between a Profile 8 and a Profile 9 soil is the texture of the upper soil horizon; Profile 8 soils are coarser.

Profile 10 soil is formed from organic matter which typically builds up due to saturated conditions. Organic soils have at least 16 inches to several feet of organic materials, in various stages of decomposition, on the soil surface. Organic soils generally indicate the presence of a wetland; however, they can also form in cold climates (high mountains and northeast coast).

Profile 11 soil is commonly formed from deposits along rivers and streams (alluvial), flood plains or beach dunes. They are recent deposits, geologically, and typically do not have well-developed soil profiles. Profile 11 soils are quite variable in texture, depending upon the velocity and type of depositional environment. Textures typically range from sand to silt. Beach dunes are typically fine to medium sand and flood plains are typically very fine sand and silt. Because of the great variability on textures, disposal area sizing is based upon textures encountered at each specific site, using other soil profile ratings as guidance.

Profile 12 soil is filled land, greater than 48 inches, placed upon the original soil surface. They will obviously vary greatly in texture, structure and consistency, depending upon

the source of fill and do not have a typical soil profile description. They can generally be determined by the observance of buried horizons which are typically found at the soil surface, the presence of artifacts and/or presence of unnatural horizons and textural combinations.

Soil Depth Classes

Soil depth to bedrock is a design parameter in the Subsurface Wastewater Disposal Rules due to concern with contamination of groundwater in bedrock fractures. Once a contaminant reaches a bedrock fracture, it no longer is subject to further purification and simply undergoes dilution. The contaminant can potentially travel great distances in a bedrock fracture, potentially reaching a groundwater drinking source. Because of this potential phenomena and concerns with groundwater drinking supplies, a two foot separation is required from the bottom of a disposal area and the upper limits of bedrock. Soil depth classes are:

AI	=	0" to 12" to bedrock from mineral soil surface
AII	=	12" to 15" to bedrock from mineral soil surface
AIII	=	15" to 48" to bedrock from mineral soil surface

Soil Conditions and Design Classes

Typical (One Limiting Factor):

When Site Evaluators report soil profiles and design classes, the standard procedure is to first state the soil profile designation, followed by the design class.

Example: Sandy loam glacial till soil with a hardpan at 24 inches and a seasonal water table at 13 inches. The soil profile and design class would be recorded as 3D with a limiting factor at 13 inches.

Atypical (More Than One Limiting Factor):

Occasionally, a soil profile will be encountered that has more than one limiting factor, such as a seasonal water table within 48 inches of the soil surface and bedrock. In such cases, the standard procedure is to list the soil profile first, followed by the bedrock depth class, a slash and then the drainage class.

Example: Sandy loam glacial till soil with no hardpan, water table at 18 inches and bedrock at 31 inches. This soil profile and design class would be recorded as **2AIII/C** with a limiting factor at 18 inches.

Most Limiting of Factors:

The most limiting factor is considered to be the factor and its separation distance that causes the disposal system to be at the highest elevation.

Example: Silt loam glacial till soil with a restrictive layer at 20 inches and bedrock at 24 inches. No drainage mottles or other evidence of a seasonal water table. This soil profile and design class would be recorded as **1AIII/B** with a limiting factor at 24 inches. The limiting factor is identified as being at 24 inches, bedrock, whereas the restrictive layer is nearer the surface, at 20 inches. The reason for this is because the bedrock requires a 24 inch separation (placing the disposal system on the soil surface) whereas the hardpan only requires a 12 inch separation (could cut 8 inches into the ground for a disposal system installation). Therefore, the bedrock is the more limiting of the two limiting factors observed.

Table 8. Sizing of Stone Disposal Areas from Table 7

<u>Soil Type</u>	<u>Soil Profile</u>	<u>Hydraulic Loading Rate (HLR) Area (Sq. ft.) for each required gal/day of wastewater</u>
Coarse Sands, Gravels	6	2.0
Loamy Sands, Fine and Medium Sands	4, 5	2.6
Loams, Sandy Loams, Loamy Sands	2, 3, 7	3.3
Silt Loams	1, 8	4.1
Silty Clay Loams, Silty Clay	9	5.0
varies	11	varies
varies	12	varies

DISPOSAL AREA CALCULATIONS

The following formula is utilized by the *State of Maine, Subsurface Wastewater Disposal Rules* to calculate disposal area size:

$$\text{MAI} = \text{DF} \times \text{AF} \times \text{HLR}$$

Parameters:

MAI is the minimum square feet of stone/soil interface bottom and sidewall area below the invert of the distribution system required.

DF is the design flow reference from a table or as determined by actual measured reading, adjusted for peak days as determined from the Code (gals/day).

AF is the adjustment factor for wastewater strength entering the disposal area, taken from the Code. This number is derived from the formula $\sqrt[3]{[\text{BOD}_5 + \text{SS (expressed in mg/l)}] \div 240 \text{ mg/l}}$.

BOD₅ = Biochemical Oxygen Demand (5-Day) (mg/l)

TSS = Total Suspended Solids (mg/l)

HLR is the hydraulic loading rate from Table 7 for the Soil Profile (sq. ft. /gpd).

The **Minimum Area Interface** is the working area of the disposal system for a disposal bed or trench system. It is the stone/soil interface of the bottom and sidewall area below the elevation of the invert of the distribution lines.

The **Design Flow** (DF) or average daily wastewater generation is taken from tables in the Code that projects average daily flows in gallons/day, or from measured readings.

The **Adjustment Factor** will, in most domestic wastewater applications be equal to 1.0 unless it receives pre-treatment, in which case it will be less than 1.0, depending on the degree of treatment, but in no case will the Adjustment Factor be lower than 0.5. If the wastewater is from a facility producing high levels of wastewater strength, as measured in biochemical oxygen demand and total suspended solids, the AF will be greater than 1.0, in accordance with its strength.

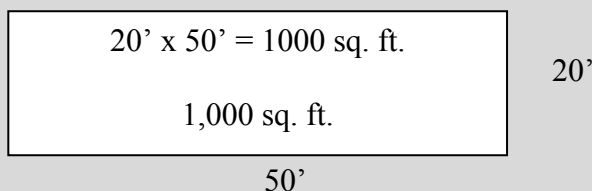
The **Hydraulic Loading Rate (HLR)** is the disposal area required for each gallon/day of wastewater generated. Coarse textured soils require less area to dispose of each gallon of wastewater than fine textured soils, due to their greater permeability.

Stone Disposal Beds

Stone disposal bed design utilizes the equation cited in *Disposal Area Calculations*. The sidewall area is relatively small and insignificant in wide beds. As bed design is elongated and narrowed, the sidewall area becomes significant (see example below).

Example:

WIDE BED: 20' wide x 50' long bed area has 1000 square feet of bottom area.

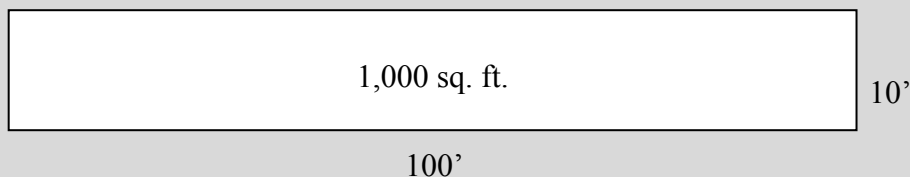


The 20' x 50' bed has 70 square feet of *effective* sidewall area. The effective sidewall area is calculated by multiplying the perimeter length by the depth of stone beneath the distribution pipe (expressed in feet).

Perimeter x Depth of Stone Below Pipe (ft):

(50' + 50' + 20' + 20') x 0.5' = 70 sq. ft.

NARROW BED: If the bed were reconfigured to 10' wide by 100' long, it would have the same bottom area.



However, the *effective* sidewall area would significantly increase.

Perimeter (ft) x Depth of Stone Below Pipe (ft):

$$(100' + 100' + 10' + 10') \times 0.5' = 110 \text{ sq. ft.}$$

[The intent of the Code is to encourage longer and narrower systems giving a credit to the sidewall area].

BED DESIGN EXAMPLE:

Profile 3

Hydraulic Loading Rate (HLR) = 3.3 sq. ft. /gpd (Table 8)

Design Flow (DF) = 270 gpd

Adjustment Factor (AF) = 1.0

MAI = DF x AF x HLR

$$\text{MAI} = 270 \text{ gpd} \times 1.0 \times 3.3 \text{ sq. ft. /gpd}$$

$$\text{MAI} = 891 \text{ square feet}$$

To determine disposal area length:

1. Choose disposal area width and stone depth.

Example: Designer selects 20' wide disposal area and 12" stone depth.

2. Subtract effective end sidewall area from MAI

$$[(20' + 20') \times 0.05' = 20 \text{ sq. ft.}]$$

$$891 \text{ sq. ft.} - 20 \text{ sq. ft.} = 871 \text{ sq. ft.}$$

3. Determine square foot equivalent for each linear foot of disposal area:

$$[(20 \text{ square feet of bottom area} + [(1 = 1) \times 0.5] \text{ square foot of sidewall area/linear foot of bed} = 21 \text{ square feet of bed/linear foot.}]$$

4. Divide net MAI by square footage/linear foot:

$$871 \div 21 = 42'$$

A 20' x 42' bed is required in this example.

Narrow Beds (Trenches)

Narrow disposal bed (trench) design utilizes the same equation in *Disposal Area Calculations*. The sidewalls of narrow bed (trench) systems are significant compared to the bottom area.

Example:

A narrow bed or trench 3' wide (average width of backhoe bucket excavation) with 12" of stone has 4 sq. ft. of *effluent* trench area per linear foot of trench.

Table 9 illustrates length of above stone trench required for each gallon/day of wastewater for various soil types per the *State of Maine Subsurface Wastewater Disposal Rules* (May 1, 1995).

NARROW BED (TRENCH) DESIGN EXAMPLE:

Profile 3

Hydraulic Loading Rate (HLR) = 3.3 sq. ft. /gpd (Table 8)

Design Flow (DF) = 270 gpd

Adjustment Factor (AF) = 1.0

$$\text{MAI} = \text{DF} \times \text{AF} \times \text{HLR}$$

$$\text{MAI} = 270 \text{ gpd} \times 1.0 \times 3.3 \text{ sq. ft. / gpd}$$

$$\text{MAI} = 891 \text{ square feet}$$

If a typical 3' wide trench with 12" deep stone layer is selected, there is:

(3 square feet of bottom area + 1 square foot of sidewall area)/linear foot of bed = 4 square feet of trench/linear foot
(end area is insignificant)

$$891 \div 4 = 222'$$

A 3' wide x 222' long narrow bed (trench) with 12" of stone depth is required in this example.

Table 9.
LINEAR FEET OF STONE BED* REQUIRED
PER GALLON/DAY OF WASTEWATER FOR
VARIOUS WIDTHS

Soil Profile	HYDRAULIC LOADING (Sq. ft/gal)	WIDTH OF BED										
		3'	4'	5'	6'	7'	8'	9'	10'	12'	15'	20'
6,	2.0	0.50	0.40	0.33	0.28	0.25	0.22	0.20	0.18	0.15	0.125	1.10
4, 5	2.6	0.65	0.52	0.43	0.37	0.33	0.29	0.26	0.23	0.20	0.16	0.12
2, 3, 7	3.3	0.82	0.66	0.55	0.47	0.41	0.37	0.33	0.30	0.25	0.20	0.15
1, 8	4.1	1.03	0.82	0.68	0.58	0.52	0.45	0.41	0.37	0.32	0.25	0.19
9	5.0	1.25	1.0	0.83	0.71	0.63	0.55	0.5	0.45	0.38	0.31	0.23

*Assumes a 12" deep stone bed and disregards end wall area

Proprietary Leaching Device

The number of proprietary disposal devices required is determined by dividing the stone bed square foot equivalent afforded to each unit into the MAI. The equivalent rating depends on disposal area layout; a larger equivalent is given for trenches than for cluster designs due to an increase in sidewall contact (see Table 10). A smaller relative disposal area size is required for proprietary devices because of the absence of stone making the interface area, see following examples).

FILL REQUIREMENTS

The number of inches of fill required from final grade of a disposal area to the original grade is calculated and reported. The depth of fill required is determined by using the slope gradient, size of disposal area, depth of disposal area, soil profile condition (i.e. depth to limiting factor) and the minimum separation distances from the bottom of the disposal area to the limiting factor.

PROPRIETARY DISPOSAL DEVICE DESIGN

EXAMPLE 1:

Profile 3

Hydraulic Loading Rate (HLR) = 3.3 sq. ft. / gpd (Table 8)

Design Flow (DF) = 270 gpd

Adjustment Factor (AF) = 1.0

$$\text{MAI} = \text{DF} \times \text{AF} \times \text{HLR}$$

$MAI = 270 \text{ gpd} \times 1.0 \times 3.3 \text{ sq. ft. / gpd}$
 $MAI = 891 \text{ square feet}$

If an approved pre-cast concrete chamber unit is selected that is 4' wide by 8' long/unit to be clustered. The Code specifies that this unit has an effective area of 64 square feet/unit.

$891 \div 64 \text{ sq. ft. /unit} = 13.9 \text{ units (14 units)}$

EXAMPLE 2:

Profile 1

Hydraulic Loading Rate (HLR) = 4.10 sq. ft. /gpd (Table 8)

Design Flow (DF) = 180 gpd

$MAI = DF \times HLR$

$MAI = 180 \text{ gpd} \times 4.10 \text{ sq. ft /gpd}$

$MAI = 738 \text{ square feet}$

If approved gravel-less fabric covered disposal area tubing that is 10 inches in diameter is selected, to be used in trenches, the Code specifies that this unit and design has an effective area of 5 sq. ft. per foot of unit.

$738 \text{ sq. feet area} \div 5 \text{ sq. ft. / ft.} = 147 \text{ linear feet required.}$

Table 10 Sizing for “Bio-Diffusor”, “Infiltrator”, “EnviroChamber”, and “Contactor” proprietary disposal devices

Device	Model	Height	Configuration	
			Cluster	Trench
Bio-Diffusor	Low profile	11"	36 sq ft/unit	44 sq ft/unit ^[a]
Bio-Diffusor	Standard	14"	36 sq ft/unit	50 sq ft/unit ^[a]
<i>Bio-Diffusor</i>	<i>Bio 2</i>	12"	18 sq ft/unit	28.8 sq ft/unit
<i>Bio-Diffusor</i>	<i>Bio 3</i>	12"	26.4 sq ft/unit	43.2 sq ft/unit
Infiltrator	EQ 24	11"	33.3 sq ft/unit ^[b]	33.3 sq ft/unit ^[c,d]
Infiltrator	Standard	12"	36 sq ft/unit	44 sq ft/unit ^[a]
Infiltrator	High Capacity	16"	36 sq ft/unit	50 sq ft/unit ^[a]
Enviro Chamber	Standard	16"	36 sq ft/unit	44 sq ft/unit ^[a]
Enviro Chamber	High Capacity	17"	36 sq ft/unit	50 sq ft/unit ^[a]
Contactor	EZ-24	12"	16.5 sq ft/unit	6.21 sq ft/linear ft
Contactor 75	Contactor "C"	12"	36 sq ft/unit	44 sq ft/unit ^[e]
Contactor 100	100	12"	48 sq ft/unit	57 sq ft/unit
Contactor 125	125	18"	36 sq ft/unit	50 sq ft/unit ^[e]
Contactor	Recharger 180	20"	44 sq ft/unit	63 sq ft/unit
Contactor 375	Tripdrain	30"	64 sq ft/unit	90 sq ft/unit ^[e]
Contactor	Recharger 330	30"	65.25 sq ft/unit	98.25 sq ft/unit
Contactor	Recharger 400	32"	29 sq ft/unit	57.6 sq ft/linear ft
Contactor	Field Drain C1-C4	8"	57.8 sq ft/unit	N/A

[a] 36" from edge to edge (stone to stone, if stone is used).

[b] 12" from edge to edge on level systems (see manufacturer's installation guide).

[c] 18 " edge to edge for single row trenches.

[d] 6" edge to edge in 2 rows per trench with 36" between trenches.

[e] 6' from center to center in trench configuration.

There are two common methods used for calculating fill depths and length of fill extension: **SLOPE** and **CORNER ELEVATION methods**.

SLOPE Method

The **SLOPE method** utilizes the field data collected by measuring one representative slope gradient of the existing ground at the location of a proposed disposal area. The slope is usually measured with a clinometer or abney level. Additionally, the elevation of the existing ground at the highest corner of the proposed system is measured, usually by a hand held level, relative to the established elevation reference point. This method is quick but less precise than the corner elevation method. It is most applicable when:

- ❑ the disposal system is small;
- ❑ the terrain is nearly level to gently sloping;
- ❑ the slope is uniform throughout the proposed disposal area length;
- ❑ the disposal area length is positioned directly perpendicular to the ground slope;
- ❑ the system and proposed fill extensions are amply distanced from property lines.

CORNER ELEVATION METHOD

The **CORNER ELEVATION method** utilizes the field data collected by measuring the elevation of the existing ground at the corners of the proposed disposal system relative to the established elevation reference point. The elevations are usually measured with a hand held level or tripod mounted level. Any break in slope within the fill extension area is also usually recorded.

This method is more precise and sensitive to slope variations throughout the proposed disposal area. It is most applicable when:

- ❑ the disposal system is large;
- ❑ the terrain is steeply sloping;
- ❑ the slope is not uniform or is complex;
- ❑ the disposal area length is not exactly positioned perpendicular to the ground slope;
- ❑ the system and fill extensions are near property line.

SLOPE METHOD Example (see Figure 35):

Soil conditions (used for design purposes) – **Profile 3, Condition C**

Depth to Limiting Factor (to be projected to Highest Elevation)	(L _f) (inches)	= 16"
Separation Distance to Limiting Factor	(S _d) (inches)	= 12"
Shoulder Width	(S _w) (feet)	= 3"
Shoulder Slope	(S _s) (0 to 3%)	= .03 (3%)
Length of Disposal Bed	(L) (feet)	= 45'
Original Slope	(S ₁) (0 to 20%)	= .12 (12%)
Width of Disposal Bed	(W) (feet)	= 20'
Thickness of Disposal Bed	(D) (inches)	= 24"
Fill Extension Slope	(E _s) (25 to 50%)	= .25 (25%)

PARAMETERS TO BE CALCULATED BELOW:

F _{up} = Fill required Upslope (inches)	F _{dn} = Fill required Downslope (inches)
F _{up} S = Fill required at Upslope shoulder (inches)	F _{dn} S = Fill required at Downslope Shoulder (inches)
Ext _{up} = Fill extension length upslope (feet)	Ext _{dn} = Fill extension length Downslope (feet)

SLOPE METHOD (Measure 1 representative slope of existing grade)

Calculation Example:

Average Slope Gradient (measured with SLOPE Method) (S₁) = 12% (.12)

$F_{up} = D + S_d - L$	$F_{dn} = (12''/\text{ft} \times W \times S_1) + F_{up}$
$F_{up} = 24'' + 12'' - 16'' = 20''$	$F_{dn} = (12''/\text{ft} \times 20 \times .12) + 20$ $= 28.8 + 20 = 48.8'' \text{ or } 49''$
$F_{up}S = F_{up} - [S_w \times (S_a + S_1) \times 12'']$	$F_{dn}S = S_w (S_L - S_8) \times 12''/\text{ft} + F_{dn}$
$F_{up}S = 20'' [3' \times (.03 + .12) \times 12'']$ $F_{up}S = 20'' - 5.4 = 14.6'' \text{ or } 15''$	$F_{dn}S = 3 (.12 - .03) \times 12''/\text{ft} = 49''$ $F_{dn}S = 52.2'' \text{ or } 52''$
$Ext_{up} = (F_{up}S \div 12''/\text{ft}) \div (E_8 + S_1)$	$Ext_{dn} = (F_{dn}S \div 12) \div (E_8 - S_1)$
$Ext_{up} = (15'' \div 12'') \div (.25 + .12)$ $Ext_{up} = 3.37' \text{ or } 3''$	$Ext_{dn} = (52 \div 12) \div (.25 - .12)$ $Ext_{dn} = 33.3' \text{ or } 33'$

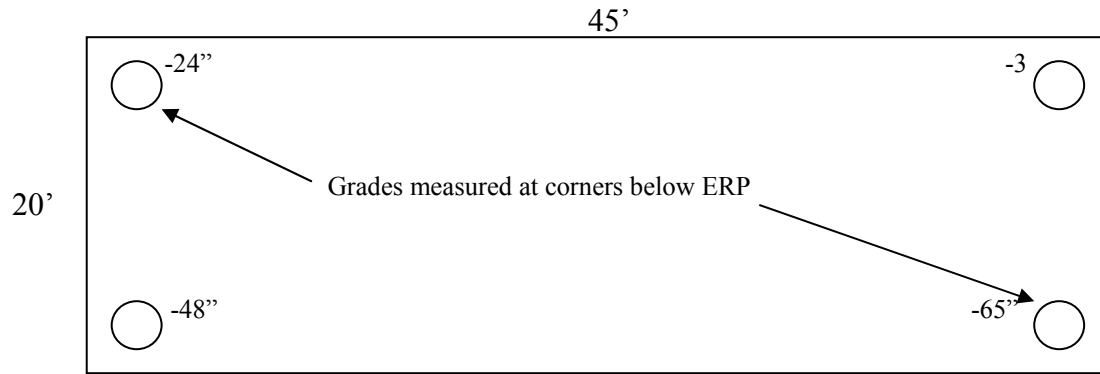


Figure 36. *Corner Elevation Method illustrating corner grade elevations measured*

Calculation Example: Determining Disposal Area Elevations (See Figure 37)

Elevation of Disposal Area Bottom

$$(E_{BB}) = \text{Elev at Highest Corner} - L_f + S_d$$

$$(E_{BB}) = -24'' - 16'' + 12''$$

$$(E_{BB}) = -28''$$

Elevation of Top of System

$$(E_{BS}) = E_{BB} + D$$

$$(E_{BS}) = -28'' + 24''$$

$$(E_{BS}) = -04''$$

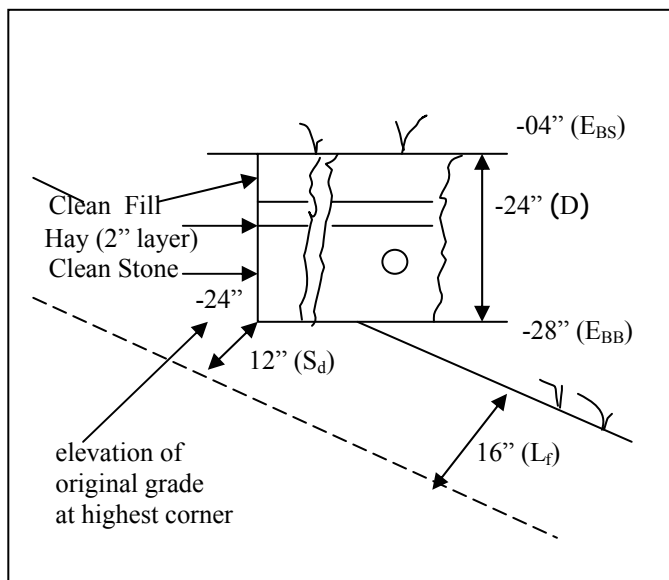


Figure 37: *Method illustrating calculated proper disposal bed elevation*

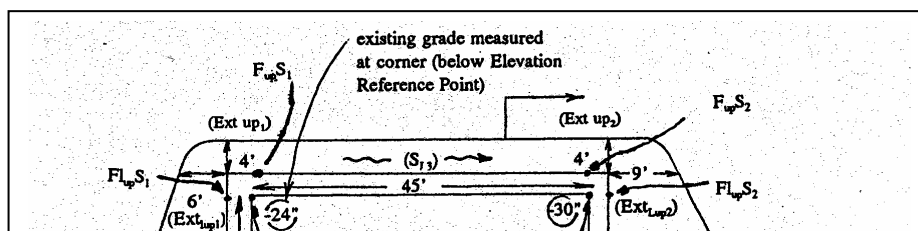


Figure 38: *Corner elevation method of disposal area calculations utilized in example*

A soil and Site Evaluator, along with a completed subsurface wastewater disposal design, is finalized in a three-page set of plans called a **Subsurface Wastewater Disposal Application HHE-200 Form** (see Figures 39a, 39b and 39c). This form is the application for the permit to install a subsurface wastewater disposal system. This form will be processed as discussed in Chapter IV.

Corner Elevation Method:

CORNER ELEVATION METHOD (EXAMPLE) (see Figures 36, 37, and 38):

Soil Conditions (used for design purposes) – **Profile 3, Condition C**

Depth to Limiting Factor (to be projected to Highest Elevation)	(L_f) (inches)	= 16"
Separation Distance to Limiting Factors	(S_d) (inches)	= 12"
Shoulder Width	(S_w) (feet)	= 3'
Shoulder Slope	(S_s) (.00 to .03)	= 3% (.03)
Length of Disposal Bed	(L) (feet)	= 45'
Width of Disposal Bed	(W) (feet)	= 20'
Fill Extension Slope	(E_s) (.25 to .50)	= 25% (.25)

PARAMETERS TO BE CALCULATED BELOW:

E_{AB}	= Elevation of Disposal Area Bottom
E_{AS}	= Elevation of Disposal Area Surface
S_{L1}	= Slope of Existing Ground across width at one end
S_{L2}	= Slope of Existing Ground across width at other end
S_{L3}	= Slope of Existing Ground along upslope length
S_{L4}	= Slope of Existing Ground along downslope length
$F_{up(1)(2)}$	= Fill upslope required at each upslope corner
$F_{dn(1)(2)}$	= Fill downslope required at each downslope corner
$Ext\ up_{(1)(2)}$	= Fill extension length (feet) upslope at each corner
$Ext\ dn_{(1)(2)}$	= Fill extension length (feet) downslope at each corner
$F_{upS(1)(2)}$	= Fill at upslope shoulder side corner
$F_{dnS(1)(2)}$	= Fill at downslope shoulder side corner
$Flup_{(1)(2)}$	= Fill at upslope shoulder lateral corner
$Fldn_{(1)(2)}$	= Fill at downslope shoulder lateral corner

CORNER ELEVATION METHOD TO CALCULATE SLOPE (See Figure 38)

$$S_{L1,2} = \frac{[\text{Elevation at uphill corner (inches)} - \text{Elevation at Downhill Corner (inches)}] \div 12}{\text{Width of System (W)}}$$

$$S_{L1} = \frac{[-24 - (-48'')]}{20}$$

$$S_{L2} = \frac{[-30' - (-65'')]}{20}$$

$$S_{L1} = 10\%$$

$$S_{L2} = 14.5 \text{ or } 15\%$$

$$S_{L3,4} = \frac{[\text{Elevation Up}_1 - \text{Elevation Up}_2] \div 12''}{\text{Length (L)}}$$

$$S_{L4} = \frac{[\text{Elev Dn}_1 - \text{Elev Dn}_2] \div 12''}{45'}$$

$$S_{L3} = \frac{[-24' - (-30'')]}{45}$$

$$S_{L4} = \frac{[-48' - (-65'')]}{45}$$

$$S_{L3} = 1.1\% \text{ or } 1\%$$

$$S_{L4} = 3.1\% \text{ or } 3\%$$

**CORNER ELEVATION METHOD
DEPTH OF FILL CALCULATIONS
(see Figure 38)**

The upslope fill at each corner is equal to the disposal area surface (E_{BS}) minus the grade measured at corner (Up).

$$Fup_1 = E_{BS} - Up_1$$

$$Fup_2 = E_{BS} - Up_2$$

$$Fup_1 = -04' - (-24')$$

$$Fup_2 = -04' - (-30')$$

$$Fup_1 = 20'$$

$$Fup_2 = 26'$$

The downslope fill at each corner is equal to the disposal area surface (E_{BS}) minus the grade measured at corner (Dn).

$$Fdn_1 = E_{BS} - Dn_1$$

$$Fdn_2 = E_{BS} - Dn_2$$

$$Fdn_1 = -04' - (-48')$$

$$Fdn_2 = -04' - (-65')$$

$$Fdn_1 = 44'$$

$$Fdn_2 = 61'$$

The depth of fill at shoulders are calculated below:

$F_{upS_1} = F_{up1} - [S_w \times (S_{L1} + S_s) \times 12'']$	$F_{upS_2} = F_{up2} - [S_w \times (S_{L2} + S_s) \times 12'']$
$F_{upS_1} = 20'' - [3' \times (.10 + .03) \times 12'']$	$F_{upS_2} = 26'' - [3' \times (.15 + .03) \times 12'']$
$F_{upS_1} = 20 - 4.68'' = 15''$	$F_{upS_2} = 26'' - 6.48'' = 20''$
$F_{dnS_1} = F_{dn1} + [S_w \times (S_{L1} + S_s) \times 12'']$	$F_{dnS_2} = F_{dn2} + [S_w \times (S_{L2} - S_s) \times 12'']$
$F_{dnS_1} = 44 + 3 (.10 - .03) \times 12''$	$F_{dnS_2} = 61'' + 3' (.15 - .03) \times 12''$
$F_{dnS_1} = 44 + 2.52'' = 47''$	$F_{dnS_2} = 61'' + 4.32'' = 65''$
$F_{lup1} = F_{up1} - [S_w \times (S_s + S_{L3}) \times 12'']$	$F_{lup2} = F_{up2} - [S_w \times (S_s + S_{L3}) \times 12'']$
$F_{lup1} = 20'' - [3' \times (.03 + .01) \times 12'']$	$F_{lup2} = 26'' + 3' \times (.03 - .01) \times 12''$
$F_{lup1} = 20 - 1.44 = 19''$	$F_{lup2} = 26'' + .72 = 27''$
$F_{ldn1} = F_{dn1} - [S_w \times (S_s + S_{L4}) \times 12'']$	$F_{ldn2} = F_{dn2} - [S_w \times (S_s - S_{L4}) \times 12'']$
$F_{ldn1} = 44'' - [3 \times (.03 + .03) \times 12]$	$F_{ldn2} = 61'' + 3 \times (.03 - .03) \times 12''$
$F_{ldn1} = 44 - 2.16'' = 42''$	$F_{ldn2} = 61'' + 0'' = 61''$
$Ext_{up1} = (F_{upS_1} \div 12) \div (E_s + S_{L1})$	$Ext_{up2} = (F_{upS_2} \div 12) \div (E_s - S_{L2})$
$Ext_{up1} = (15 \div 12) \div (.25 + .10)$	$Ext_{up2} = (20'' \div 12) \div (.25 - .15)$
$Ext_{up1} = 1.25 \div .35 = 3.57 \text{ or } 4'$	$Ext_{up2} = 1.66 \div (.40) = 4.15 \text{ or } 4'$
$Ext_{dn1} = (F_{dnS_1} \div 12) \div (E_s + S_{L1})$	$Ext_{dn2} = (F_{dnS_2} \div 12) \div (E_s - S_{L2})$
$Ext_{dn1} = (47'' \div 12) \div (.25 - .10)$	$Ext_{dn2} = (65'' \div 12) \div (.25 - .15)$
$Ext_{dn1} = 3.92 \div .15 = 26.11 \text{ or } 26'$	$Ext_{dn2} = 5.58 \div (.10) = 54.2 \text{ or } 54'$
$Ext_{lup1} = (F_{lupS_1} \div 12) \div (E_s + S_{L3})$	$Ext_{lup2} = (F_{lupS_2} \div 12) \div (E_s - S_{L3})$
$Ext_{lup1} = (19 \div 12) \div (.25 + .10)$	$Ext_{lup2} = (27'' \div 12) \div (.25 - .01)$
$Ext_{lup1} = 1.58 \div .26 = 6.08 \text{ or } 6''$	$Ext_{lup2} = 2.25 \div (.24) = 9.37 \text{ or } 9'$
$Ext_{ldn1} = (F_{ldnS_1} \div 12) \div (E_s + S_{L4})$	$Ext_{ldn2} = (F_{ldnS_2} \div 12) \div (E_s - S_{L4})$
$Ext_{ldn1} = (42'' \div 12) \div (.25 + .03)$	$Ext_{ldn2} = (61'' \div 12) \div (.25 - .03)$
$Ext_{ldn1} = 3.5 \div .28 = 12.5 \text{ or } 13'$	$Ext_{ldn2} = 5.08 \div (.22) = 23.10 \text{ or } 23'$

IV. ADMINISTRATION, PERMITTING AND DISPOSAL SYSTEM INSPECTION

SYNOPSIS:

This chapter discusses the administration and inspection of subsurface wastewater disposal systems. Included in this chapter are a discussion of permitting, forms issued by the Division of Health Engineering, and equipment needed for inspection. This section should be of particular interest to the local plumbing inspector and regulators and contains background information of interest to site evaluators, excavating contractors, planning board members, and property owners.

TOPICS:

State administration of Subsurface Wastewater Disposal Programs, Site Evaluator Program, Local Plumbing Inspector Program, permits, applications, forms, inspection practices, violations of Rules, record keeping.

STATE ADMINISTRATION

The **Department of Human Services, Division of Health Engineering**, is the State agency responsible for administering the *Subsurface Wastewater Disposal Rules*.

The Division of Health Engineering is authorized by Maine Law, 22 MRSA, 42 to develop rules that provide the State of Maine minimum design criteria for subsurface wastewater disposal. The rules are meant to assure environmental sanitation and protection of public health. The *State of Maine, Subsurface Wastewater Disposal Rules* (10-144A CMR 241) govern siting, design, construction, and inspection of subsurface wastewater disposal systems.

There are two exceptions:

- ❑ *public sewer systems* and *overboard waste discharge systems* are administered by the **Maine Department of Environmental Protection**.
- ❑ *Hazardous waste materials* are regulated by the **Maine Department of Environmental Protection**.

The Division of Health Engineering assures compliance with the *Subsurface Wastewater Disposal Rules* through two programs: the licensed Site Evaluator Program and the Certified Plumbing Inspector Program.

SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION

Maine Department of Human Services
Division of Health Engineering, Station 10
(207) 287-5672 FAX (207) 287-4172

PROPERTY LOCATION		<p align="center">>> Caution: Permit Required – Attach in Space Below <<</p> <p>The Subsurface Wastewater Disposal System shall not be installed until a Permit is attached HERE by the Local Plumbing Inspector. The Permit shall authorize the owner or installer to install the disposal system in accordance with this application and the Maine Subsurface Wastewater Disposal Rules.</p>
City, Town, or Plantation	Monmouth	
Street or Road	RT # 202	
Subdivision, Lot #		
OWNER/APPLICANT INFORMATION		
Name (last, first, MI)	Smith John	<input checked="" type="checkbox"/> Owner <input type="checkbox"/> Applicant
Mailing Address	95 WASHINGTON ST	
Daytime Tel. #	Augusta ME 04301	
Owner or Applicant Statement I state that the information submitted is correct to the best of my knowledge and understand that any falsification is reason for the Department and/or Local Plumbing Inspector to deny a Permit. <u>John Smith</u> <u>6/06/03</u> Signature of Owner or Applicant Date		Caution: Inspection Required I have inspected the installation authorized above and found it to be in compliance with the Subsurface Wastewater Disposal Rules Application. _____ (1st) Date Approved _____ (2nd) Date Approved
Municipal Tax Map # 9 Lot # 26		

PERMIT INFORMATION		
TYPE OF APPLICATION 1. <input checked="" type="checkbox"/> First Time System 2. <input type="checkbox"/> Replacement System Type Replaced: _____ Year Installed: _____ 3. <input type="checkbox"/> Expanded System a. <input type="checkbox"/> Minor Expansion b. <input type="checkbox"/> Major Expansion 4. <input type="checkbox"/> Experimental System 5. <input type="checkbox"/> Seasonal Conversion	THIS APPLICATION REQUIRES 1. <input checked="" type="checkbox"/> No Rule Variance 2. <input type="checkbox"/> First Time System Variance a. <input type="checkbox"/> Local Plumbing Inspector Approval b. <input type="checkbox"/> State & Local Plumbing Inspector Approval 3. <input type="checkbox"/> Replacement System Variance a. <input type="checkbox"/> Local Plumbing Inspector Approval b. <input type="checkbox"/> State & Local Plumbing Inspector Approval 4. <input type="checkbox"/> Experimental System 5. <input type="checkbox"/> Seasonal Conversion Approval	DISPOSAL SYSTEM COMPONENT(S) 1. <input checked="" type="checkbox"/> Complete Non-engineered System 2. <input type="checkbox"/> Primitive System (graywater & alternative toilet) 3. <input type="checkbox"/> Alternative Toilet, specify: _____ 4. <input type="checkbox"/> Non-engineered Treatment Tank (only) 5. <input type="checkbox"/> Holding Tank, capacity: _____ gallons 6. <input type="checkbox"/> Non-engineered Disposal Field (only) 7. <input type="checkbox"/> Separated Laundry System 8. <input type="checkbox"/> Complete Engineered System (2000 gpd or more) 9. <input type="checkbox"/> Engineered Treatment Tank (only) 10. <input type="checkbox"/> Engineered Disposal Field (only) 11. <input type="checkbox"/> Pre-treatment, specify: _____ 12. <input type="checkbox"/> Miscellaneous components
SIZE OF PROPERTY 20+ <input type="checkbox"/> sq. ft. <input checked="" type="checkbox"/> acres	DISPOSAL SYSTEM TO SERVE 1. <input checked="" type="checkbox"/> Single Family Dwelling Unit, No. of Bedrooms: 2 2. <input type="checkbox"/> Multiple Family Dwelling, No. of Units: _____ 3. <input type="checkbox"/> Other: _____ SPECIFY _____	
SHORELAND ZONING <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	TYPE OF WATER SUPPLY 1. <input checked="" type="checkbox"/> Drilled Well 2. <input type="checkbox"/> Dug Well 3. <input type="checkbox"/> Private 4. <input type="checkbox"/> Public 5. <input type="checkbox"/> Other: Proposed	

DESIGN DETAILS (SYSTEM LAYOUT SHOWN ON PAGE 3)			
TREATMENT TANK 1. <input type="checkbox"/> Concrete a. <input type="checkbox"/> Regular b. <input type="checkbox"/> Low Profile 2. <input type="checkbox"/> Plastic 3. <input type="checkbox"/> Other: _____ CAPACITY: 1000 gallons	DISPOSAL FIELD TYPE & SIZE 1. <input checked="" type="checkbox"/> Stone Bed 2. <input type="checkbox"/> Stone Trench 3. <input type="checkbox"/> Proprietary Device a. <input type="checkbox"/> Cluster array c. <input type="checkbox"/> Linear b. <input type="checkbox"/> Regular load d. <input type="checkbox"/> H-20 Load 4. <input type="checkbox"/> Other: _____ SIZE: 472 <input checked="" type="checkbox"/> sq. ft. <input type="checkbox"/> lin. ft.	GARBAGE DISPOSAL UNIT 1. <input checked="" type="checkbox"/> No 2. <input type="checkbox"/> Yes 3. <input type="checkbox"/> Maybe >> If yes/maybe, specify one below: a. <input type="checkbox"/> Multi-Compartment Tank b. <input type="checkbox"/> Tanks in Series c. <input type="checkbox"/> Increase in Tank Capacity d. <input type="checkbox"/> Filter on Tank Outlet	DESIGN FLOW 180 gallons-per-day (gpd) BASED ON: 1. <input checked="" type="checkbox"/> Table 501.1 (dwelling unit(s)) 2. <input type="checkbox"/> Table 501.2 (other facilities) SHOW CALCULATIONS -- for other facilities --
SOIL DATA & DESIGN CLASS PROFILE CONDITION DESIGN 5 • C • 2 at Observation Hole # 1 Depth 24 • Elevation -71 • OF MOST LIMITING SOIL FACTOR	DISPOSAL FIELD SIZING 1. <input type="checkbox"/> Small -- 2.0 sq. ft./gpd 2. <input checked="" type="checkbox"/> Medium -- 2.6 sq. ft./gpd 3. <input type="checkbox"/> Medium-Large -- 3.3 sq. ft./gpd 4. <input type="checkbox"/> Large -- 4.1 sq. ft./gpd 5. <input type="checkbox"/> Extra Large -- 5.0 sq. ft./gpd	EFFLUENT/EJECTOR PUMP 1. <input type="checkbox"/> Not Required 2. <input checked="" type="checkbox"/> May Be Required 3. <input type="checkbox"/> Required >> Specify dose for engineered & experimental systems DOSE: 20-30 gallons	3. <input type="checkbox"/> Section 503.0 (meter readings) ATTACH WATER-METER DATA

SITE EVALUATOR STATEMENT			
I certify that on <u>6/01/03</u> (date) I completed a site evaluation on this property and state that the data reported herein are accurate and that the proposed system is in compliance with the Maine Subsurface Wastewater Disposal Rules (10-144A CMR 241).			
<u>David P. Roegue</u> Site Evaluator Signature	<u>154</u> SE #	<u>6/02/03</u> Date	
<u>David P. Roegue</u> Site Evaluator Name (Printed)	<u>(207) 287-2666</u> Telephone #	<u>N/A</u> E-Mail Address	Page 1 of 3 HHE-200 Rev. 8/01

Figure 39a: Application for On-site Subsurface Wastewater Disposal System (Page 1)

SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION

Maine Department of Human Services
 Division of Health Engineering, Station 10
 (207) 287-5872 FAX (207) 287-4172

Town, City, Plantation
Monmouth

Street, Road, Subdivision
Rt 202

Owner or Applicant Name
John Smith

SITE PLAN

Scale: 1" = 50 ft

SITE LOCATION MAP

(Attach map from Maine Atlas for First Time System Variance)

SOIL PROFILE DESCRIPTION AND CLASSIFICATION

(Location of Observation Holes Shown Above)

Observation Hole # TP1 ☒ Test Pit ☐ Boring

0 " Depth of organic horizon above mineral soil

Texture	Consistency	Color	Mottling
0			
6	<u>Friable</u>	<u>Dark Brown</u>	<u>None Observed</u>
12		<u>Dark Yellow Brown</u>	
18		<u>Light Brown</u>	
24		<u>Olive Brown</u>	<u>Common Distinct</u>
30	<u>Loose</u>		
36			
42			
48			

Soil Profile 5
 Classification Condition C

Slope 6 Percent
 Limiting Factor Depth 24

☒ Groundwater
☐ Restrictive Layer
☐ Bedrock

Observation Hole # TP2 ☒ Test Pit ☐ Boring

0 " Depth of organic horizon above mineral soil

Texture	Consistency	Color	Mottling
0			
6		<u>Dark Brown</u>	<u>None Observed</u>
12	<u>Friable</u>	<u>Dark Yellow Brown</u>	
18		<u>Light Brown</u>	
24		<u>Grayish Brown</u>	<u>Common Distinct</u>
30	<u>Loose</u>		
36			
42			
48			

Soil Profile 5
 Classification Condition C

Slope 6 Percent
 Limiting Factor Depth 24

☐ Groundwater
☐ Restrictive Layer
☐ Bedrock

David Recque
 Site Evaluator Signature

154
 SE #

6/02/03
 Date

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Figure 39b: Application for On-site Subsurface Wastewater Disposal System (page 2)

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SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION		Maine Department of Human Services Division of Health Engineering, Station 10 (207) 287-5672 FAX (207) 287-4172
Town, City, Plantation <u>Monmouth</u>	Street, Road, Subdivision <u>Rt 202</u>	Owner or Applicant Name <u>John Smith</u>

SUBSURFACE WASTEWATER DISPOSAL PLAN

Scale: 1" = 20 ft.

ERP = Flagged nail in 14" Oak
w/ 8.5" Above Ground

Flagged 4" post/nail

D-Box (INSULATED COVER
w/ 2" const. poly-
styrene)

Make septic
tank + pump
sta. water-tight.

Septic TANK + Pump
Station
(can be separate)

2" Force main - Insulate
to prevent freezing
use baffle in D-Box
to attenuate flow

Disposal Field to be 15' x 31.5'
Stone bed with two 4" perforated pipes
5' apart and 5' from sides + end of stone.

BACKFILL REQUIREMENTS	CONSTRUCTION ELEVATIONS	ELEVATION REFERENCE POINT
Depth of Backfill (upslope) <u>24"</u>	Finished Grade Elevation <u>-37"</u>	Location & Description: <u>Nail in</u>
Depth of Backfill (downslope) <u>30-38"</u>	Top of Distribution Pipe or Proprietary Device <u>-49"</u>	<u>14" Oak tree</u>
DEPTHS AT CROSS-SECTION (shown below)	Bottom of Disposal Field <u>-60"</u>	Reference Elevation is: 0.0" or: _____

DISPOSAL FIELD CROSS SECTION

Scales:
Vertical: 1" = 2 ft.
Horizontal: 1" = 5 ft.

Vertical: 1" = 2 ft.
Horizontal: 1" = 5 ft.

Remove sod then mix 4" of gravelly coarse sand into prepared soil surface

<u>David Pogue</u> Site Evaluator Signature	<u>154</u> SE #	<u>6/02/03</u> Date
--	--------------------	------------------------

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Figure 39c: Application for On-site Subsurface Wastewater Disposal System (page 3)

SITE EVALUATION PROGRAM

Since July 1974, the **Department of Human Services, Division of Health Engineering** has licensed persons to practice Site Evaluation. Site Evaluation is the practice of evaluating, reporting and applying basic soil and site conditions to subsurface wastewater disposal and system design. This is accomplished in compliance with the *State of Maine, Subsurface Wastewater Disposal Rules*. In order to become licensed, individuals must meet basic educational and experience criteria and also pass two exams. The written exam tests an applicant's knowledge of the Rules, design ability and soils. Upon successful completion of the written exam, an applicant must then pass the field exam. The field exam tests the applicant's ability to describe, evaluate, and classify soil profiles. The applicant's soil descriptions are compared to a master description, created by comparing results of several experts who have described soil test pits before the exam is given. The successful applicant must demonstrate a thorough knowledge of the Rules, engineering design capabilities and soil science principles.

The **Site Evaluation** program is directly overseen by the **State Site Evaluator (SSE)**. The SSE not only reviews applications for Site Evaluators but also administers site evaluator exams and addresses issues involving questions or complaints regarding site evaluation. Field review of disposal systems on proposed sites are commonly performed by the SSE in the administration of the program. A person interested in becoming a licensed Site Evaluator should be very familiar with Chapters I, II and III before taking the Site Evaluator Examination. A licensed Site Evaluator is authorized to complete the Subsurface Wastewater Disposal Application as described in Chapter III.

LOCAL PLUMBING INSPECTOR PROGRAM

The **Division of Health Engineering** is also responsible for administering the *Subsurface Wastewater Disposal Rules* and appointing Local Plumbing Inspectors in the unorganized territories of Maine. Certification of Local Plumbing Inspectors is the responsibility of the **Maine State Planning Office, Code Enforcement Officer Training and Certification Program**. A Local Plumbing Inspector is a Municipal or Department of Human Services appointed official charged with implementing the Rules and carrying out duties required by 30-A MRSA § 4221. Local Plumbing Inspector applicants must pass a code enforcement exam section dealing with *Legal Issues and Enforcement Techniques* as well as exam sections covering *Subsurface Wastewater Disposal Rules* and *Internal Plumbing Rules*. Certificates are issued to successful applicants and maintained through continuing education. Once the exams have been successfully completed, the individual must then be appointed by the Municipality or, in unorganized areas of Maine, by the Department of Human Services. Responsibilities of Local Plumbing Inspectors include conducting inspections and issuing permits. The details of the training and certification of Local Plumbing Inspectors and other Code Enforcement Officers are contained in 30-A MRSA § 4451.

A person interested in becoming a Local Plumbing Inspector should be very familiar with Chapters I, IV and V of the *Subsurface Wastewater Disposal Rules* and *Internal Plumbing Rules* before taking the Local Plumbing Inspector Examination.

PERMITS, APPLICATIONS AND ASSOCIATED ADMINISTRATIVE FORMS

Permits are required for any work related to Subsurface Wastewater Disposal Systems except for the following:

- Maintenance of a pump, siphon or accessory equipment
- Clearance of a stoppage
- Sealing of a leak in a treatment tank, building sewer or effluent line
- Adding fill material or extending fill extension with notification of the Local Plumbing Inspector

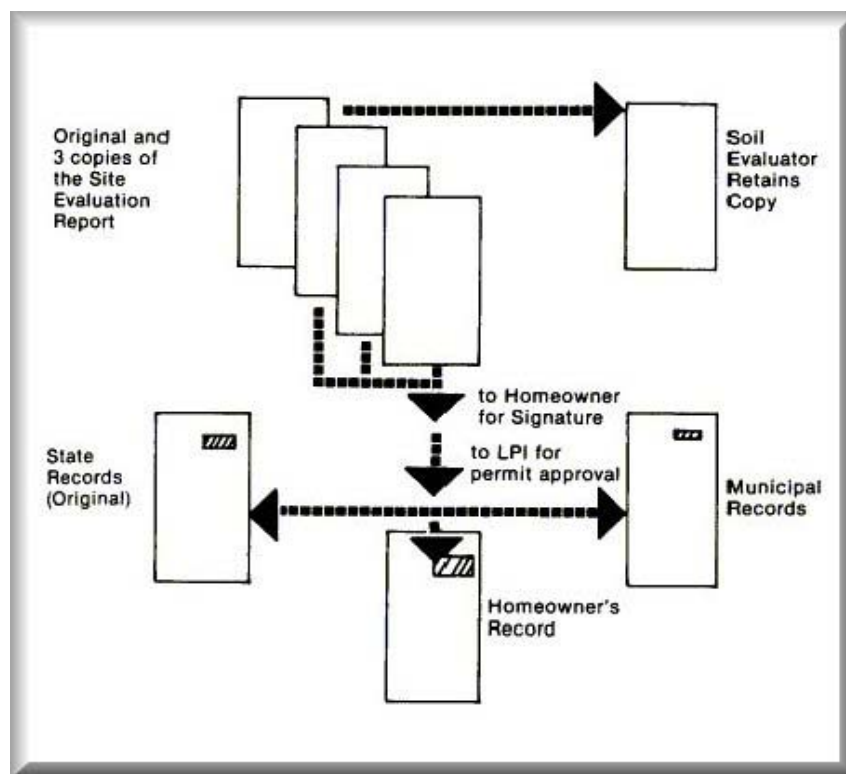


Figure 40. *Distribution of Copies of the Application*

In order for a Local Plumbing Inspector to issue a permit, he or she needs to determine that the application is complete, in full compliance with the current *Subsurface Wastewater Disposal Rules*, and that full payment of the permit fee has been received.

Any applicant who wants to obtain a permit to install a complete disposal system or an individual disposal system component should present the Local Plumbing Inspector with a subsurface wastewater disposal application, completed by a licensed Site Evaluator. A Local Plumbing Inspector may initiate the application for those applicants who want to replace the septic tank only. Work may not be started on any system until an application has a signed permit label

attached to it. Permits are valid for up to two years. If no work has been started within two years, the permit becomes void.

It is the responsibility of the Local Plumbing Inspector to keep good records of permits issued. Permit labels are issued on sheets in sets of three; one is attached to an application for the Local Plumbing Inspector's records, a second is attached to a copy of the application for the owner, and the third is attached to a copy of the application for the State's records. The State copy should be forwarded to the Department of Human Services Plumbing Program along with their share of the minimum basic permit fee. Refer to Rules for specific fee structure and Division of Health Engineering's percentage.

Department of Human Services
Division of Health Engineering
11 State House Station
Augusta, Maine 04333-0010

A Subsurface Wastewater Disposal Application is not needed for Replacement Treatment Tank.

A subsurface wastewater disposal application completed by a Site Evaluator is not needed if an applicant wants to install only a *replacement* treatment tank. Generally, the Local Plumbing Inspector has a supply of first pages of the Subsurface Wastewater Disposal Application in which the Local Plumbing Inspector can initiate the creation of the permit application by merely filling out the applicant's address information and denoting the size of the proposed replacement septic tank. A replacement tank application is labeled as a permitted operation and a fee is charged.

If the work goes beyond the replacement of only the treatment tank, then a subsurface wastewater disposal application completed by a Site Evaluator is required.

A Subsurface Wastewater Disposal Application (HHE-200 form) is required to be completed by a Licensed Site Evaluator for all complete subsurface wastewater disposal systems or for individual disposal areas. The application then needs to be reviewed and permitted by the Local Plumbing Inspector. A permit label is affixed to the subsurface wastewater disposal application if the Local Plumbing Inspector finds it acceptable. The permit label authorizes the work.

REVIEW OF SUBSURFACE WASTEWATER DISPOSAL APPLICATION (HHE-200 FORM)

The LPI should review a subsurface wastewater disposal application (HHE-200 form) for completeness before affixing a permit label. In addition, the LPI should be familiar with the Subsurface Wastewater Disposal Rules to determine whether or not any errors are present, and which must be corrected. A step-by-step breakdown of the HHE-200 form follows:

SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION		Maine Department of Human Services Division of Health Engineering, Station 10 (207) 287-5672 FAX (207) 287-4172	
PROPERTY LOCATION City, Town, or Plantation: <u>Monmouth</u> Street or Road: <u>RT # 202</u> Subdivision, Lot #: _____		>> Caution: Permit Required -- Attach in Space Below << <div style="border: 1px solid black; padding: 5px;"> The Subsurface Wastewater Disposal System <i>shall not</i> be installed until a Permit is attached HERE by the Local Plumbing Inspector. The Permit shall authorize the owner or installer to install the disposal system in accordance with this application and the Maine Subsurface Wastewater Disposal Rules. </div>	
OWNER/APPLICANT INFORMATION Name (last, first, MI): <u>Smith John</u> <input checked="" type="checkbox"/> Owner <input type="checkbox"/> Applicant Mailing Address of <input checked="" type="checkbox"/> Owner <input type="checkbox"/> Applicant: <u>95 WASHINGTON ST</u> <u>Augusta ME 04330</u> Daytime Tel. #: <u>555-2020</u>		Municipal Tax Map # <u>9</u> Lot # <u>26</u> Owner or Applicant Statement I state that the information submitted is correct to the best of my knowledge and understand that any falsification is reason for the Department and/or Local Plumbing Inspector to deny a Permit. <u>John Smith</u> <u>6/06/03</u> Signature of Owner or Applicant Date	
PERMIT INFORMATION TYPE OF APPLICATION 1. <input checked="" type="checkbox"/> First Time System 2. <input type="checkbox"/> Replacement System Type Replaced: _____ Year Installed: _____ 3. <input type="checkbox"/> Expanded System a. <input type="checkbox"/> Minor Expansion b. <input type="checkbox"/> Major Expansion 4. <input type="checkbox"/> Experimental System 5. <input type="checkbox"/> Seasonal Conversion		THIS APPLICATION REQUIRES 1. <input checked="" type="checkbox"/> No Rule Variance 2. <input type="checkbox"/> First Time System Variance a. <input type="checkbox"/> Local Plumbing Inspector Approval b. <input type="checkbox"/> State & Local Plumbing Inspector Approval 3. <input type="checkbox"/> Replacement System Variance a. <input type="checkbox"/> Local Plumbing Inspector Approval b. <input type="checkbox"/> State & Local Plumbing Inspector Approval 4. <input type="checkbox"/> Experimental System 5. <input type="checkbox"/> Seasonal Conversion Approval	
SIZE OF PROPERTY <u>20+</u> <input type="checkbox"/> sq. ft. <input checked="" type="checkbox"/> acres SHORELAND ZONING <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		DISPOSAL SYSTEM TO SERVE 1. <input checked="" type="checkbox"/> Single Family Dwelling Unit, No. of Bedrooms: <u>2</u> 2. <input type="checkbox"/> Multiple Family Dwelling, No. of Units: _____ 3. <input type="checkbox"/> Other: _____ SPECIFY _____	
DISPOSAL SYSTEM COMPONENT(S) 1. <input checked="" type="checkbox"/> Complete Non-engineered System 2. <input type="checkbox"/> Primitive System (graywater & alternative toilet) 3. <input type="checkbox"/> Alternative Toilet, specify: _____ 4. <input type="checkbox"/> Non-engineered Treatment Tank (only) 5. <input type="checkbox"/> Holding Tank, capacity: _____ gallons 6. <input type="checkbox"/> Non-engineered Disposal Field (only) 7. <input type="checkbox"/> Separated Laundry System 8. <input type="checkbox"/> Complete Engineered System (2000 gpd or more) 9. <input type="checkbox"/> Engineered Treatment Tank (only) 10. <input type="checkbox"/> Engineered Disposal Field (only) 11. <input type="checkbox"/> Pre-treatment, specify: _____ 12. <input type="checkbox"/> Miscellaneous components		TYPE OF WATER SUPPLY 1. <input checked="" type="checkbox"/> Drilled Well 2. <input type="checkbox"/> Dug Well 3. <input type="checkbox"/> Private 4. <input type="checkbox"/> Public 5. <input type="checkbox"/> Other: <u>Proposed</u>	
DESIGN DETAILS (SYSTEM LAYOUT SHOWN ON PAGE 3)			
TREATMENT TANK 1. <input type="checkbox"/> Concrete a. <input type="checkbox"/> Regular b. <input type="checkbox"/> Low Profile 2. <input type="checkbox"/> Plastic 3. <input type="checkbox"/> Other: _____ CAPACITY: <u>1000</u> gallons SOIL DATA & DESIGN CLASS PROFILE: <u>5</u> • CONDITION: <u>C</u> • DESIGN: <u>2</u> at Observation Hole # <u>1</u> Depth <u>24</u> • Elevation <u>71</u> OF MOST LIMITING SOIL FACTOR		DISPOSAL FIELD TYPE & SIZE 1. <input checked="" type="checkbox"/> Stone Bed 2. <input type="checkbox"/> Stone Trench 3. <input type="checkbox"/> Proprietary Device a. <input type="checkbox"/> Cluster array c. <input type="checkbox"/> Linear b. <input type="checkbox"/> Regular load d. <input type="checkbox"/> H-20 Load 4. <input type="checkbox"/> Other: _____ SIZE: <u>472</u> <input checked="" type="checkbox"/> sq. ft. <input type="checkbox"/> lin. ft. DISPOSAL FIELD SIZING 1. <input type="checkbox"/> Small -- 2.0 sq. ft./gpd 2. <input checked="" type="checkbox"/> Medium -- 2.6 sq. ft./gpd 3. <input type="checkbox"/> Medium-Large -- 3.3 sq. ft./gpd 4. <input type="checkbox"/> Large -- 4.1 sq. ft./gpd 5. <input type="checkbox"/> Extra Large -- 5.0 sq. ft./gpd	
GARBAGE DISPOSAL UNIT 1. <input checked="" type="checkbox"/> No 2. <input type="checkbox"/> Yes 3. <input type="checkbox"/> Maybe >> If yes/maybe, specify one below: a. <input type="checkbox"/> Multi-Compartment Tank b. <input type="checkbox"/> Tanks in Series c. <input type="checkbox"/> Increase in Tank Capacity d. <input type="checkbox"/> Filter on Tank Outlet		DESIGN FLOW <u>180</u> gallons-per-day (gpd) BASED ON: 1. <input checked="" type="checkbox"/> Table 501.1 (dwelling unit(s)) 2. <input type="checkbox"/> Table 501.2 (other facilities) SHOW CALCULATIONS -- for other facilities -- 3. <input type="checkbox"/> Section 503.0 (meter readings) ATTACH WATER-METER DATA	
EFFLUENT/JECTOR PUMP 1. <input type="checkbox"/> Not Required 2. <input checked="" type="checkbox"/> May Be Required 3. <input type="checkbox"/> Required >> Specify dose for engineered & experimental systems DOSE: <u>20-30</u> gallons			
SITE EVALUATOR STATEMENT I certify that on <u>6/01/03</u> (date) I completed a site evaluation on this property and state that the data reported herein are accurate and that the proposed system is in compliance with the Maine Subsurface Wastewater Disposal Rules (10-144A CMR 241). <u>David P. Roague</u> <u>154</u> <u>6/02/03</u> Site Evaluator Signature SE # Date <u>David P. Roague</u> <u>(207) 287-2666</u> <u>N/A</u> Site Evaluator Name (Printed) Telephone # E-Mail Address			

Figure 41. Index of Subsurface Wastewater Disposal Application, Page 1

1. **Property owners name and address:** The property address where the disposal system is to be located must be filled in, as well as the property owner or applicant's name. The applicant is the person who is seeking the permit and is to be contacted if any questions regarding the application arise. In most cases, the applicant is the property owner, but occasionally the applicant is an agent for the property owner, such as a contractor or developer.

PROPERTY LOCATION	
City, Town, or Plantation	Monmouth
Street or Road	RT # 202
Subdivision, Lot #	
OWNER/APPLICANT INFORMATION	
Name (last, first, MI)	Smith John <input checked="" type="checkbox"/> Owner <input type="checkbox"/> Applicant
Mailing Address of <input checked="" type="checkbox"/> Owner <input type="checkbox"/> Applicant	95 WASHINGTON ST Augusta ME 0430
Daytime Tel. #	555-2020

Figure 42: *Property Owner and name information*

2. **Owner/Applicant Statement:** This is where the owner or applicant, whichever is seeking the permit, signs the subsurface wastewater disposal application (HHE-200 form) as an indication that the information on the application is accurate. The applicant or owner is only responsible for information that he/she should be knowledgeable about, such as property size, structure, property line, etc. It is not expected that the owner or applicant will be knowledgeable regarding soil evaluation or design specifications.

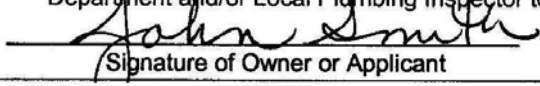
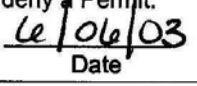
Owner or Applicant Statement	
I state that the information submitted is correct to the best of my knowledge and understand that any falsification is reason for the Department and/or Local Plumbing Inspector to deny a Permit.	
	
Signature of Owner or Applicant	Date

Figure 43. *Owner statement*

3. **Permit Sticker Location:** This is the location that the permit sticker is affixed to a subsurface wastewater disposal application (HHE-200) and represents a permit has been issued, once the sticker has been affixed. The State supplies the LPI with 3 permit stickers for each permit number. One is affixed to the copy of the subsurface wastewater disposal application (HHE-200) and returned to the applicant; a second is affixed to another copy of the HHE-200 form and sent to the State for their records. The third is affixed to a third copy of the subsurface wastewater disposal application (HHE-200) and kept by the LPI for his or her records. State Law 30-A § 4221 requires the Local Plumbing Inspector keep a complete record of all transactions, including fees collected and transferred. The Rules require that system permits and associated records shall be maintained until such time as the realty improvement served by the proposed or existing system is removed or connected to a public sewer. The Rules also require a percentage of the appropriate fee be forwarded to the State (refer to the Subsurface Wastewater Disposal Rules). Any fees for locally administered variances or additional town adopted permit fees assessed by the town may be kept by the town in their entirety. State copies of the application and State fees should be submitted to:

Department of Human Services
Division of Health Engineering
11 State House Station
Augusta, Maine 04333-0010

State Law 30-A § 4215 requires that “the remainder of the fee shall be paid to the treasurer of the Municipality”.

This section also has a space for tax map number and lot number of the property where the disposal system is to be located. Filling this space out is optional and not required for permit issuance

>> Caution: Permit Required – Attach in Space Below <<

The Subsurface Wastewater Disposal System **shall not** be installed until a Permit is attached HERE by the Local Plumbing Inspector. The Permit shall authorize the owner or installer to install the disposal system in accordance with this application and the Maine Subsurface Wastewater Disposal Rules.

Municipal Tax Map # 9 Lot # 26

Caution: Inspection Required
I have inspected the installation authorized above and found it to be in compliance with the Subsurface Wastewater Disposal Rules Application.

Local Plumbing Inspector Signature

(1st) Date Approved

(2nd) Date Approved

Figure 44. *Permit sticker location*

4. **Permit Information:** This section includes the following blocks, all of which must be filled out before a permit can be issued:
- Application Type** – the form should indicate whether the application is for a first-time system (a property where no system is presently located); a multi-user system (three or more structures under different ownership using a single disposal field) replacement system, expanded system both exempted and non-exempted, experimental system, or seasonal conversion.

The LPI should pay particular attention to this section to be sure the appropriate box is checked off. Criteria which must be met varies according to the permit type requested. First time system criteria are the most stringent, and include application for properties where illegal systems are being replaced or where the property has been unused for many years and is in a state of disrepair. Multi-user systems only apply to systems

where 3 or more structures, under different ownership, are to be served by a single system or a single system component, such as a disposal field. Replacement systems apply to the replacement of existing, legal, subsurface wastewater disposal systems or proposed licensed overboard discharge systems (not to be confused with existing buildings that do not have a legal system). This category should not be confused with replacements where additional wastewater flow is to be generated, such as the addition of a bedroom, employees or the change from an alternative toilet to a flush toilet.

Expansion of Existing Subsurface Wastewater Disposal Systems

The rules define expansion as a change in use of a structure that results in an increased wastewater design flow requiring the installation of larger disposal system components than are present as part of the existing system. Any activity meeting this definition that occurs after May 1, 1995 constitutes an expansion. Expansions are divided into two types, minor and major.

A minor expansion can only occur once, and meets one of the following criteria:

1. Addition of a single bedroom to a single family dwelling;
2. Replacement of an alternative toilet with a flush toilet, if pressurized water existed in the structure prior to May 1, 1995; or
3. For commercial establishments, an increase in the wastewater design flow of 25% or less.

A major expansion meets one or more of the following criteria:

1. Addition of two or more bedrooms to a single family dwelling;
2. Introduction of pressurized water to a structure if the structure was served by hand carried or hand pumped water prior to May 1, 1995;
3. The addition of a second dwelling unit to a property already supporting one dwelling unit;
4. The second expansion of a structure already completing one minor expansion; or
5. For commercial establishments, an increase in the wastewater design flow of more than 25%.

Expansions are also governed by the wastewater disposal system's location. Outside of the Shoreland Zone, minor expansions are eligible for variances as defined in Tables 600.3 and 700.3, and do not have to be installed at the time of the expansion if the design is recorded with the appropriate registry of deeds. Major expansions also qualify for variances as defined in Tables 600.3 and 700.3; but must be installed at the time of the expansion. Within the Shoreland Zone, minor expansions qualify for variances as defined in Tables 600.4 and 700.4 and must be installed at the time of expansion.

Major expansions must meet first time system design criteria and be installed at the time of expansion.

The box for experimental system category is for those systems that are not considered as conventional and described in the Rules. No experimental system may be installed until approved by DHE. In addition, experimental systems require the design of a conventional system that can be installed in the event that the experimental system fails.

The box for seasonal conversion is to be checked off if the structure is to be converted from seasonal to year-round use. This category only applies if the structure was in existence on December 31, 1981 and was not used as a principle structure between the years of 1977 – 1981. Any structure built since 1981 has been required to have a disposal system in compliance with rules that exceeded seasonal conversion criteria, so a seasonal conversion permit is not required. For seasonal conversion permits, the applicant must meet substantial compliance criteria.

- b. **Size of Property:** This box is for noting the property size, either in square feet or acres.
- c. **Shoreland Zoning:** This box is for noting whether or not the disposal system, (not structure) is to be located within 250' of a major water course/body. The Shoreland Zone of a wetland is not intended to be noted in this box.
- d. **Application Requirements:** This box is where the applicant indicates whether or not a variance is required, and, if required, what type of variance. A First Time System Variance (Municipal) is the box for New System Variances that can be approved by the municipality (soils variance only). First Time System Variance (State) is for all other first-time system variances that require state approval. It would also apply to non-exempted expansion systems, if they require a variance.

The box for replacement system variance applies to all replacement systems, including exempted expansions. In addition, the applicant must indicate whether the variance can be approved by the LPI or requires State approval (see the Rules for LPI limit of authority).

This block also includes categories for Minimum Lot Size variance and Seasonal Conversion Variance. The box for Minimum Lot Size variance should be marked if less than 66.66 square feet of lot size is available for each gallon of wastewater generated per day (all single family dwellings are considered to generate 300 gpd for this determination). In addition, if the structure is on a property that abuts a major waterbody/course, it must have 100' of frontage for each 300 gpd of wastewater generated.

<p>MINIMUM LOT SIZE LAW Sample Calculation</p> <p>Example:</p> <p>A proposed project is on a parcel of land with 60,000 square feet and proposes to dispose of 1200 gallons per day.</p> <p>60,000 sq. ft. ÷ 1200 gpd = 50 sq. ft. of land/gpd. This would require a Minimum Lot Size Waiver. The property would need to be at best 79,992 sq. ft. to meet the Rule (i.e. 1200 gpd x 66.66 sq. ft. /gpd = 79,992 sq. ft.</p>
--

- e. **Disposal System to Serve:** This box should indicate the type of structure to be served by the disposal system; single-family dwelling, multi-family dwelling or other (such as restaurant, store, office, etc.).
- f. **Disposal System Component(s):** This is the box where the applicant indicates what the permit is for. Categories include:
 1. **Non-Engineered System** – This category should only be checked off when the application is for an entire subsurface wastewater disposal system that will handle less than 2000 gallons per day.
 2. **Primitive System** – This category is for those systems serving dwellings where water is hand-carried or hand-pumped. They are designed for a minimum of 25 gpd and a maximum of 75 gpd (25 gpd per fixture for up to 3 fixtures). These systems require the location of an area that is suitable for a full-size system, in compliance with the Rules, in the event that an applicant wishes to upgrade in the future. Primitive systems require an alternative toilet that is part of the application and do not require the alternative toilet box to be checked.
 3. **Alternative Toilet** – This box is for the permitting of an alternative toilet only when not part of a primitive system application. An alternative toilet is a non-water carriage toilet such as an outhouse, gas or compost toilet. The type of alternative toilet proposed should be specific.
 4. **Non-Engineered Treatment Tank** – This box is for a permit for the installation of a treatment tank only for a system that generates less than 2000 gpd of wastewater.

5. **Holding Tank** – If the application is for the installation of a holding tank, this box should be checked and the size of the tank specified. In addition, the type of holding tank (concrete or plastic) should be noted here or in the box where treatment tank specifications are noted.

If the holding tank is for a *new* building, the application for a commercial use must be less than 100 gpd or the municipality must have an approved *local holding tank ordinance*. Holding tanks commonly are for *replacement* systems.

6. **Non-Engineered Disposal Area (only)** – When a failing disposal field is to be replaced but the existing septic tank is to be retained, this box is to be checked. One of the more common errors on applications is checking off box #1, Non-Engineered system when, in fact, only a non-engineered disposal field is intended to be installed.
 7. **Separated Laundry System** – This box is for the design and permitting of an alternative laundry disposal system only. If an alternative laundry disposal field is proposed as part of a non-engineered system, this box should not be checked.
 8. **Engineered System (+ 2000 gpd)** – If a complete system, designed to handle 2000 gpd or more is to be permitted, this box should be checked. All engineered systems require designs by a Registered Professional Engineer and State approval prior to permitting.
 9. **Engineered Treatment Tank (only)** – This box is to be checked when a permit is requested for installing a treatment tank only for a 2000 gpd or more system.
 10. **Engineered Disposal Area (only)** – This box should be checked when the application is for the permitting of a 2000 or more gpd disposal field only.
- g. **Type of Water supply:** This box is for a description of the type of water supply to serve the structure seeking a permit. Common types of water supply are dug or drilled well and public water. Less common are spring or hand carried.

TYPE OF APPLICATION 1. <input checked="" type="checkbox"/> First Time System 2. <input type="checkbox"/> Replacement System Type Replaced: _____ Year Installed: _____ 3. <input type="checkbox"/> Expanded System a. <input type="checkbox"/> Minor Expansion b. <input type="checkbox"/> Major Expansion 4. <input type="checkbox"/> Experimental System 5. <input type="checkbox"/> Seasonal Conversion	THIS APPLICATION REQUIRES 1. <input checked="" type="checkbox"/> No Rule Variance 2. <input type="checkbox"/> First Time System Variance a. <input type="checkbox"/> Local Plumbing Inspector Approval b. <input type="checkbox"/> State & Local Plumbing Inspector Approval 3. <input type="checkbox"/> Replacement System Variance a. <input type="checkbox"/> Local Plumbing Inspector Approval b. <input type="checkbox"/> State & Local Plumbing Inspector Approval 4. <input type="checkbox"/> Experimental System 5. <input type="checkbox"/> Seasonal Conversion Approval	DISPOSAL SYSTEM COMPONENT(S) 1. <input checked="" type="checkbox"/> Complete Non-engineered System 2. <input type="checkbox"/> Primitive System (graywater & alternative toilet) 3. <input type="checkbox"/> Alternative Toilet, specify: _____ 4. <input type="checkbox"/> Non-engineered Treatment Tank (only) 5. <input type="checkbox"/> Holding Tank, capacity: _____ gallons 6. <input type="checkbox"/> Non-engineered Disposal Field (only) 7. <input type="checkbox"/> Separated Laundry System 8. <input type="checkbox"/> Complete Engineered System (2000 gpd or more) 9. <input type="checkbox"/> Engineered Treatment Tank (only) 10. <input type="checkbox"/> Engineered Disposal Field (only) 11. <input type="checkbox"/> Pre-treatment, specify: _____ 12. <input type="checkbox"/> Miscellaneous components
SIZE OF PROPERTY 20+ <input type="checkbox"/> sq. ft. <input checked="" type="checkbox"/> acres SHORELAND ZONING <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	DISPOSAL SYSTEM TO SERVE 1. <input checked="" type="checkbox"/> Single Family Dwelling Unit, No. of Bedrooms: <u>2</u> 2. <input type="checkbox"/> Multiple Family Dwelling, No. of Units: _____ 3. <input type="checkbox"/> Other: _____ SPECIFY _____	TYPE OF WATER SUPPLY 1. <input checked="" type="checkbox"/> Drilled Well 2. <input type="checkbox"/> Dug Well 3. <input type="checkbox"/> Private 4. <input type="checkbox"/> Public 5. <input type="checkbox"/> Other: <u>Proposed</u>

Figure 45: Permit information

5. **DESIGN DETAILS** – This section contains information design criteria for the disposal system or system component, and includes the following:

- a. **Treatment tank** - This is where the applicant indicates the type and size septic tank proposed. If no tank is proposed, N/A should be written in this box. If a holding tank is proposed, treatment can be crossed off and holding written in. If the existing treatment tank is to be used, existing is often written above Treatment Tank and the size indicated below.
- b. **Profile and design class** – This block should indicate the soil profile and design class used to size the disposal field. It also includes depth to the most limiting factor, the limiting factor upon which the design is based. If more than one limiting factor is present, the more limiting of the two should be used. This category is not required for treatment tank only or holding tank applications.
- c. **Disposal area type/size** – This is the block where the applicant indicates the type, size and layout of the disposal area. If proprietary devices are to be used, it should be noted as to whether they will be clustered, linear, and regular or placed in an area subject to vehicular traffic loads whereby *h-20 rated* is required. There is also a blank for “other”, where other systems, such as *peat*, can be indicated.
- d. **Disposal area sizing** – The multiplier for disposal area sizing (this number is multiplied times the design flow for sizing the disposal area) is indicated in this box. These numbers come from correctly identifying the soil profile and then consulting the appropriate sizing table of the Rules. If the wrong number is used, particularly a smaller number, the disposal area will be undersized.
- e. **Garbage disposal unit** – Since garbage disposal units generate 30% additional solids as compared to dwellings without them, provisions must be made to handle the additional solids load. Options available include: multi-compartment tanks, tanks in series, increased septic tank capacity, or a filter on the outlet end of the septic tank. It is very important that this section be completed.

- f. **Pumping** – If the disposal field is located at an elevation higher than the dwelling or treatment tank, pumping of the effluent will be required and should be noted in this block. The application should also indicate an appropriate dosage volume (generally 25 to 150 gpd/dose for single-family residences).
- g. **Criteria used for design flow** – This block is where the design flow is shown and/or calculated. Design flow is based upon assumptions of averages from similar structures, as published in the Rules. Alternately, water use monitoring of the actual water usage, with appropriate adjustment factors, can be used.

DESIGN DETAILS (SYSTEM LAYOUT SHOWN ON PAGE 3)			
TREATMENT TANK 1. <input type="checkbox"/> Concrete a. <input type="checkbox"/> Regular b. <input type="checkbox"/> Low Profile 2. <input type="checkbox"/> Plastic 3. <input type="checkbox"/> Other: _____ CAPACITY: 1000 gallons SOIL DATA & DESIGN CLASS PROFILE: 5 • CONDITION: C • DESIGN: 2 at Observation Hole # 1 Depth: 24" • Elevation: 71" OF MOST LIMITING SOIL FACTOR	DISPOSAL FIELD TYPE & SIZE 1. <input checked="" type="checkbox"/> Stone Bed 2. <input type="checkbox"/> Stone Trench 3. <input type="checkbox"/> Proprietary Device a. <input type="checkbox"/> Cluster array c. <input type="checkbox"/> Linear b. <input type="checkbox"/> Regular load d. <input type="checkbox"/> H-20 Load 4. <input type="checkbox"/> Other: _____ SIZE: 472 sq. ft. • lin. ft.	GARBAGE DISPOSAL UNIT 1. <input checked="" type="checkbox"/> No 2. <input type="checkbox"/> Yes 3. <input type="checkbox"/> Maybe >> If yes/maybe, specify one below: a. <input type="checkbox"/> Multi-Compartment Tank b. <input type="checkbox"/> Tanks in Series c. <input type="checkbox"/> Increase in Tank Capacity d. <input type="checkbox"/> Filter on Tank Outlet EFFLUENT/EJECTOR PUMP 1. <input type="checkbox"/> Not Required 2. <input checked="" type="checkbox"/> May Be Required 3. <input type="checkbox"/> Required >> Specify dose for engineered & experimental systems DOSE: 20-30 gallons	DESIGN FLOW 180 gallons-per-day (gpd) BASED ON: 1. <input checked="" type="checkbox"/> Table 501.1 (dwelling units) 2. <input type="checkbox"/> Table 501.2 (other facilities) SHOW CALCULATIONS -- for other facilities -- 3. <input type="checkbox"/> Section 503.0 (meter readings) ATTACH WATER-METER DATA

Figure 46. Design criteria information

6. **Site Evaluation Statement:** This section is where the Site Evaluator dates and signs the form, indicating that the information is accurate and design is in accordance with the Rules. The Site Evaluator must also print his/her name and include their telephone number so that they can be contacted in the event questions or concerns with the application arise.

SITE EVALUATOR STATEMENT			
I certify that on 6/01/03 (date) I completed a site evaluation on this property and state that the data reported herein are accurate and that the proposed system is in compliance with the Maine Subsurface Wastewater Disposal Rules (10-144A CMR 241).			
David Rocque	154	6/02/03	
Site Evaluator Signature	SE #	Date	
David P. Rocque	(207) 287-2666	N/A	
Site Evaluator Name (Printed)	Telephone #	E-Mail Address	

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Figure 47: Site evaluator statement

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SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION			Maine Department of Human Services Division of Health Engineering, Station 10 (207) 287-5672 FAX (207) 287-4172	
Town, City, Plantation <u>Monmouth</u>	Street, Road, Subdivision <u>Rt 202</u>	Owner or Applicant Name <u>John Smith</u>		
SITE PLAN Scale: 1" = 50' ft.			SITE LOCATION MAP <small>(Attach map from Maine Atlas for First Time System Variance)</small>	
SOIL PROFILE DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)				
Observation Hole # <u>TP1</u> <input checked="" type="checkbox"/> Test Pit <input type="checkbox"/> Boring				
0" Depth of organic horizon above mineral soil				
Texture	Consistency	Color	Mottling	
0-6" Fine Sandy Loam	Friable	Dark Brown	None Observed	
6-12" Loamy Sand		Dark Yellow Brown		
12-18" Fine + Medium Sand		Light Brown		
18-24" Fine + Medium Sand		Light Brown		
24-30" Loose		Olive Brown	Common Distinct	
30-36"				
36-42"				
42-48"				
Soil Profile <u>5</u>	Classification Condition <u>C</u>	Slope Percent <u>6</u>	Limiting Factor Depth <u>24"</u>	<input checked="" type="checkbox"/> Groundwater <input type="checkbox"/> Restrictive Layer <input type="checkbox"/> Bedrock
Observation Hole # <u>TP2</u> <input checked="" type="checkbox"/> Test Pit <input type="checkbox"/> Boring				
0" Depth of organic horizon above mineral soil				
Texture	Consistency	Color	Mottling	
0-6" Fine Sandy Loam		Dark Brown		
6-12" Loamy Sand	Friable	Dark Yellow Brown	None Observed	
12-18" Fine + Medium Sand		Light Brown		
18-24" Fine + Medium Sand		Light Brown		
24-30" Loose		Grayish Brown	Common Distinct	
30-36"				
36-42"				
42-48"				
Soil Profile <u>5</u>	Classification Condition <u>C</u>	Slope Percent <u>6</u>	Limiting Factor Depth <u>24"</u>	<input type="checkbox"/> Groundwater <input type="checkbox"/> Restrictive Layer <input type="checkbox"/> Bedrock
Site Evaluator Signature <u>David Recque</u>		SE # <u>154</u>		Date <u>6/02/03</u>

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Figure 48. Index for PAGE 2 Subsurface Wastewater Disposal Application

7. **Site Location Plan:** This is where the property location is shown upon which the proposed disposal field is to be installed. It should include sufficient landmarks and distances to allow for the LPI to find the property. If a new system variance is proposed, a copy from an atlas should be included.

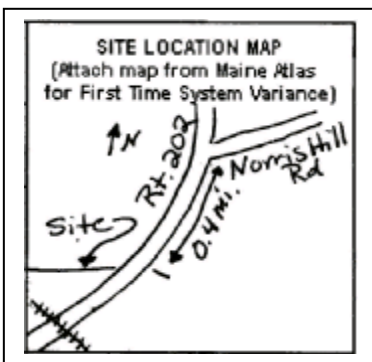


Figure 49. Site location information

8. **Site Plan:** The site plan is a drawing which shows the property as it exists, with the proposed disposal field or test pit locations. It should be drawn to scale and so indicated on the space provided. Permanent feature within 100' (for designs of systems less than 1000gpd systems), 200' (for design of systems more than 1000 gpd but less than 2000 gpd), and 300' (for the design of systems greater than 2000 gpd systems) should be shown, such as roads, wells, buildings, water bodies, driveways, tree lines, etc. A north arrow and slopes should also be shown. The drawing should be legible so that the LPI and contractor can accurately read it.

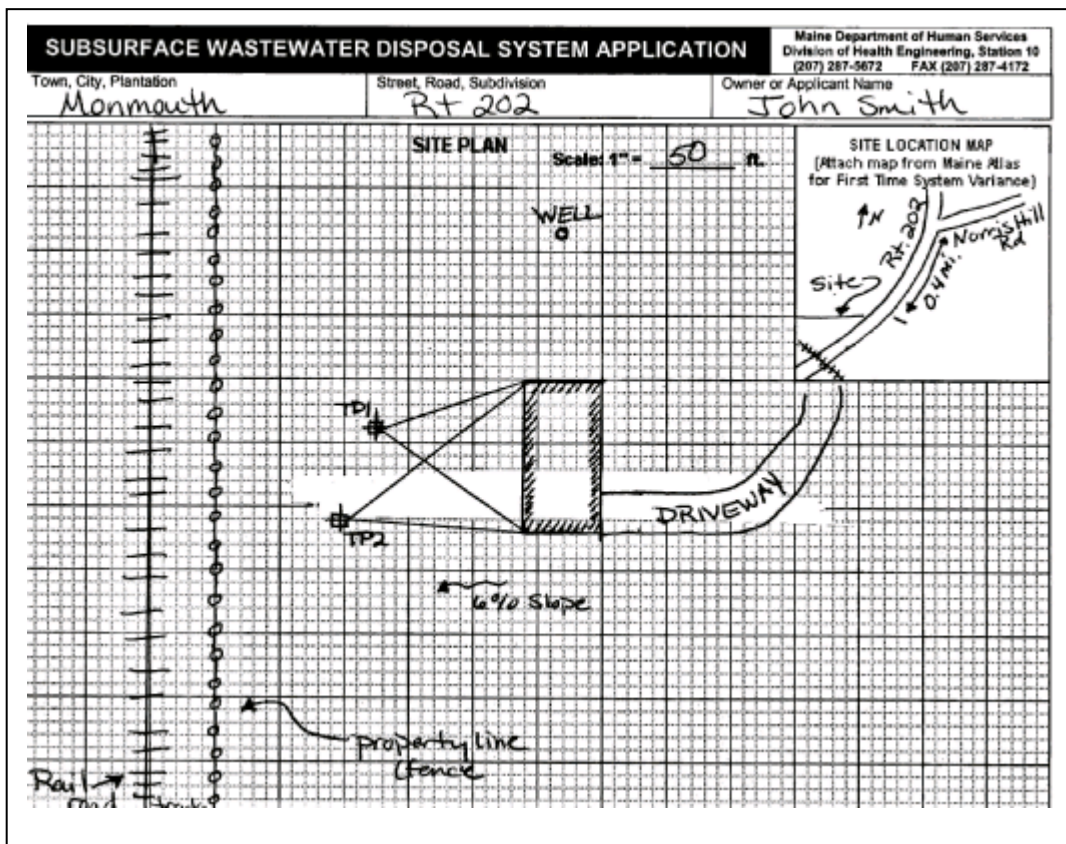


Figure 50. Site plan information

Soil Description and Classification: This is where the Site Evaluator describes the soil's texture, consistency, color and mottling observation. The soil profile, condition, slope and limiting factor(s) are also indicated. It should be noted as to whether the observation was a test pit or boring and the depth of organic matter encountered. The Site Evaluator signs, dates and records his/her license number at the page bottom.

SOIL PROFILE DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)									
Observation Hole # <u>TP1</u> <input checked="" type="checkbox"/> Test Pit <input type="checkbox"/> Boring					Observation Hole # <u>TP2</u> <input checked="" type="checkbox"/> Test Pit <input type="checkbox"/> Boring				
0" Depth of organic horizon above mineral soil					0" Depth of organic horizon above mineral soil				
0	Texture	Consistency	Color	Mottling	0	Texture	Consistency	Color	Mottling
6	Fine Sandy Loam	Friable	Dark Brown	None Observed	6	Fine Sandy Loam		Dark Brown	
12	Loamy Sand		Dark Yellow Brown		12	Loamy Sand	Friable	Dark Yellow Brown	None Observed
18	Fine + Medium Sand		Light Brown		18	Fine + Medium Sand		Light Brown	
24					24				
30		Loose	Olive Brown	Common Distinct	30		Loose	Grayish Brown	Common Distinct
36					36				
42					42				
48					48				
Soil Profile <u>5</u>		Classification Condition <u>C</u>	Slope Percent <u>6</u>	Limiting Factor Depth <u>24</u>	Soil Profile		Classification Condition	Slope Percent	Limiting Factor Depth
<input checked="" type="checkbox"/> Groundwater <input type="checkbox"/> Restrictive Layer <input type="checkbox"/> Bedrock					<input type="checkbox"/> Groundwater <input type="checkbox"/> Restrictive Layer <input type="checkbox"/> Bedrock				
<u>David Recque</u> Site Evaluator Signature					<u>154</u> SE #				
<u>6/02/03</u> Date					Page 2 of 3 HHE-200 Rev. 6/01				

Figure 51. Soil profile information

SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION		Maine Department of Human Services Division of Health Engineering, Station 10 (207) 287-5672 FAX (207) 287-4172
Town, City, Plantation <u>Monmouth</u>	Street, Road, Subdivision <u>Rt 202</u>	Owner or Applicant Name <u>John Smith</u>

SUBSURFACE WASTEWATER DISPOSAL PLAN

Scale: 1" = 20 ft.

← 10

BACKFILL REQUIREMENTS	CONSTRUCTION ELEVATIONS	ELEVATION REFERENCE POINT
Depth of Backfill (upslope) <u>24"</u>	Finished Grade Elevation <u>-37"</u>	Location & Description: <u>Nail in</u>
Depth of Backfill (downslope) <u>30-38"</u>	Top of Distribution Pipe or Proprietary Device <u>-49"</u>	<u>14" Oak tree</u>
DEPTHS AT CROSS-SECTION (shown below)	Bottom of Disposal Field <u>-60"</u>	Reference Elevation is: 0.0" or: _____

DISPOSAL FIELD CROSS-SECTION

Scales:
Vertical: 1" = 2 ft.
Horizontal: 1" = 5 ft.

← 11

← 12

<u>David Pogue</u> <small>Site Evaluator Signature</small>	<u>154</u> <small>SE #</small>	<u>6/02/03</u> <small>Date</small>	<small>Page 3 of 3 HHE-200 Rev. 6/01</small>
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Figure 52. Subsurface Wastewater Disposal Rules Index for PAGE 3

Location and size of disposal system

The Local Plumbing Inspector is responsible for measuring to the corners of the disposal area from the control points specified on the subsurface wastewater disposal application, to assure that it was constructed in the correct location as desired by the Site Evaluator. The Local Plumbing Inspector should examine page 3 of the application, where the information can be found (see Figure 54, Item #10).

Elevation of top of pipes or proprietary leaching devices

It is very important for the Local Plumbing Inspector to check the elevation of the top of distribution pipes in a bed system, or the top of the leaching devices. The contractor's equipment (tripod, level, transit, etc.) may be available from a member of the crew to assist in holding the stadia rod.

10. Subsurface Wastewater Disposal Plan: This section is where the disposal area details are shown. It should include a scale, typically 1" = 20' or greater (i.e. 1" = 100'), and any notes pertinent to the disposal system design. Details should include: disposal area plan view, showing proprietary device layout or piping, fill extensions, distribution box (if proposed) and 3' shoulder.

Other details of importance include swing ties, septic tank location, piping details, pump station location (if used), grease interceptors (if used), and any other pertinent details, such as the elevation reference point (ERP) location and cross-section location.

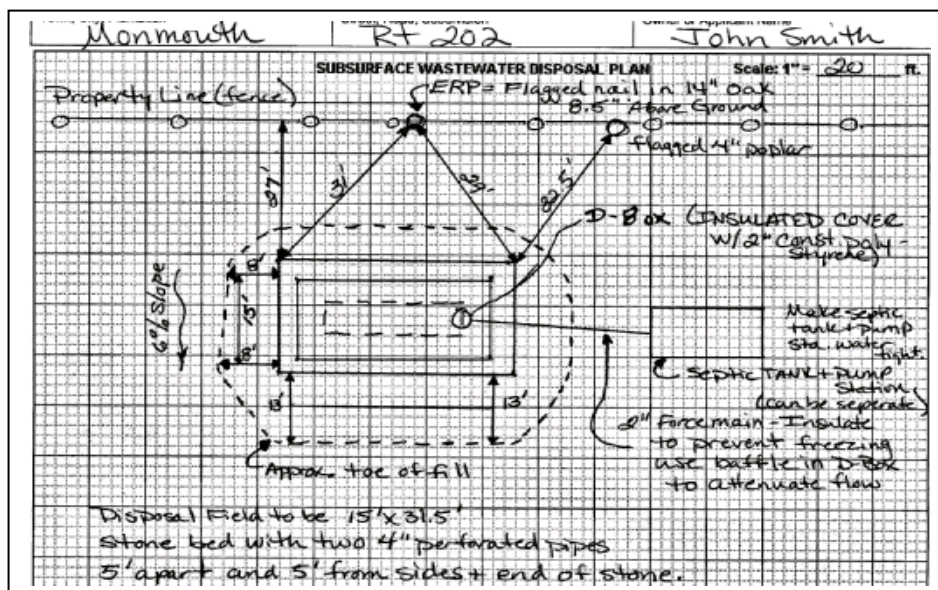


Figure 53. *Subsurface wastewater disposal plan*

11. Construction Elevations: This is the section where construction elevations are indicated. It is very important that this section be accurately completed. Depth of fill should be

indicated as well as elevation of the reference point, bottom of disposal area and top of distribution lines or proprietary devices. The Local Plumbing Inspector should make sure that the elevation reference point (ERP) is a permanent mark and located outside of the disposal field and fill extension area. The location of the ERP should be described in this section so it can be located.

BACKFILL REQUIREMENTS		CONSTRUCTION ELEVATIONS	ELEVATION REFERENCE POINT
Depth of Backfill (upslope)	24"	Finished Grade Elevation	-37"
Depth of Backfill (downslope)	30-38"	Top of Distribution Pipe or Proprietary Device	-49"
DEPTHS AT CROSS-SECTION (shown below)		Bottom of Disposal Field	-60"
		Location & Description: Nail in 14" Oak tree	
		Reference Elevation is: 0.0" or: _____	

Figure 54. Fill requirements and construction elevations

12. Disposal Area Cross-Section: The cross-section should provide sufficient detail so that the contractor can install the system as proposed by the Site Evaluator. It should include all disposal area components as well as fill extensions and stabilization measures. Curtain drains and diversion ditches, if proposed, should be shown as well as any designer specific details. The Site Evaluator must sign, date and indicate license number at the bottom of page.

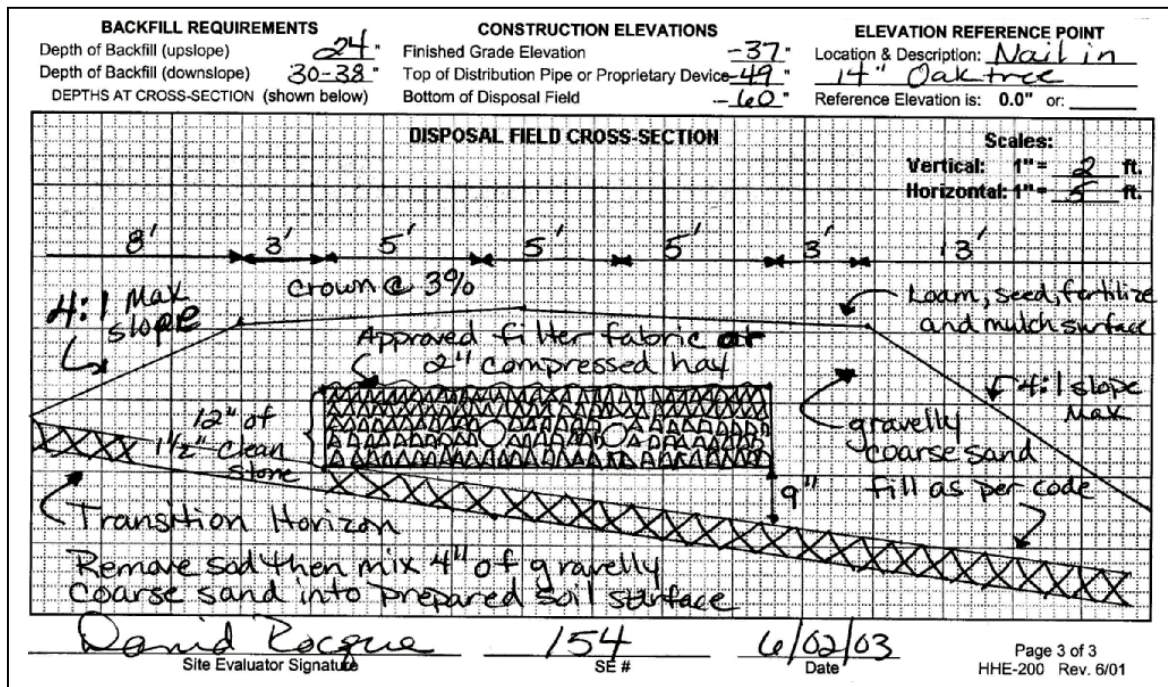


Figure 55. Disposal area cross section.

PERMITTING

The Local Plumbing Inspector should review the application for completeness and general compliance with the State of Maine Subsurface Wastewater Disposal Rules and pertinent local ordinances. The appropriate permit fee is calculated, assessed and upon collection, the permit labels are filled out and applied to the first page of the subsurface wastewater disposal application. Affixing the permit label transforms the application into the legal permit document.

Table 110.2 from the Subsurface Wastewater Disposal Rules

TABLE 110.2
MUNICIPAL AND LURC TERRITORIES PERMIT FEE SCHEDULE
 (Fees to be paid to the municipality/LPI)
Permits for complete disposal system

Engineered system	\$200.00
Non-engineered system	\$100.00
Primitive system (includes one alternative toilet)	\$100.00
Separate laundry disposal field	\$35.00
Seasonal conversion permit	\$50.00
Variance	\$20.00

Permits for separate parts of disposal system

Alternative toilet (only)	\$50.00
Disposal field (engineered system)	\$150.00
Disposal field (non-engineered system)	\$75.00
Treatment tank (non-engineered system)	\$50.00
Treatment tank (engineered system)	\$80.00
Holding tank	\$100.00
Other components (complete pump station, piping, other)	\$30.00
Variance	\$20.00

The figure displays three sample permit labels for subsurface wastewater disposal. Each label is a rectangular form with a header section and a main body section.

- Labels to affix to town & state copy of application:** This label is the largest and contains a large dashed rectangular area in the center. To the right of this area are four vertical columns of text, each with a heading and a series of checkboxes or lines for data entry. The headings are: "Disposal Field", "Treatment Tank", "Holding Tank", and "Other Components".
- Permit label to affix to property owner's application:** This label is smaller than the first one. It contains a smaller dashed rectangular area in the center. To the right of this area are two vertical columns of text, each with a heading and a series of checkboxes or lines for data entry. The headings are: "Disposal Field" and "Treatment Tank".
- Data record to remain with LPI file:** This label is the smallest and contains a series of horizontal lines for data entry. The headings for these lines are: "Property Address", "Property Owner", "Permit Number", "Disposal Field", "Treatment Tank", "Holding Tank", and "Other Components".

Figure 56. Sample of Subsurface Wastewater Disposal Permit labels

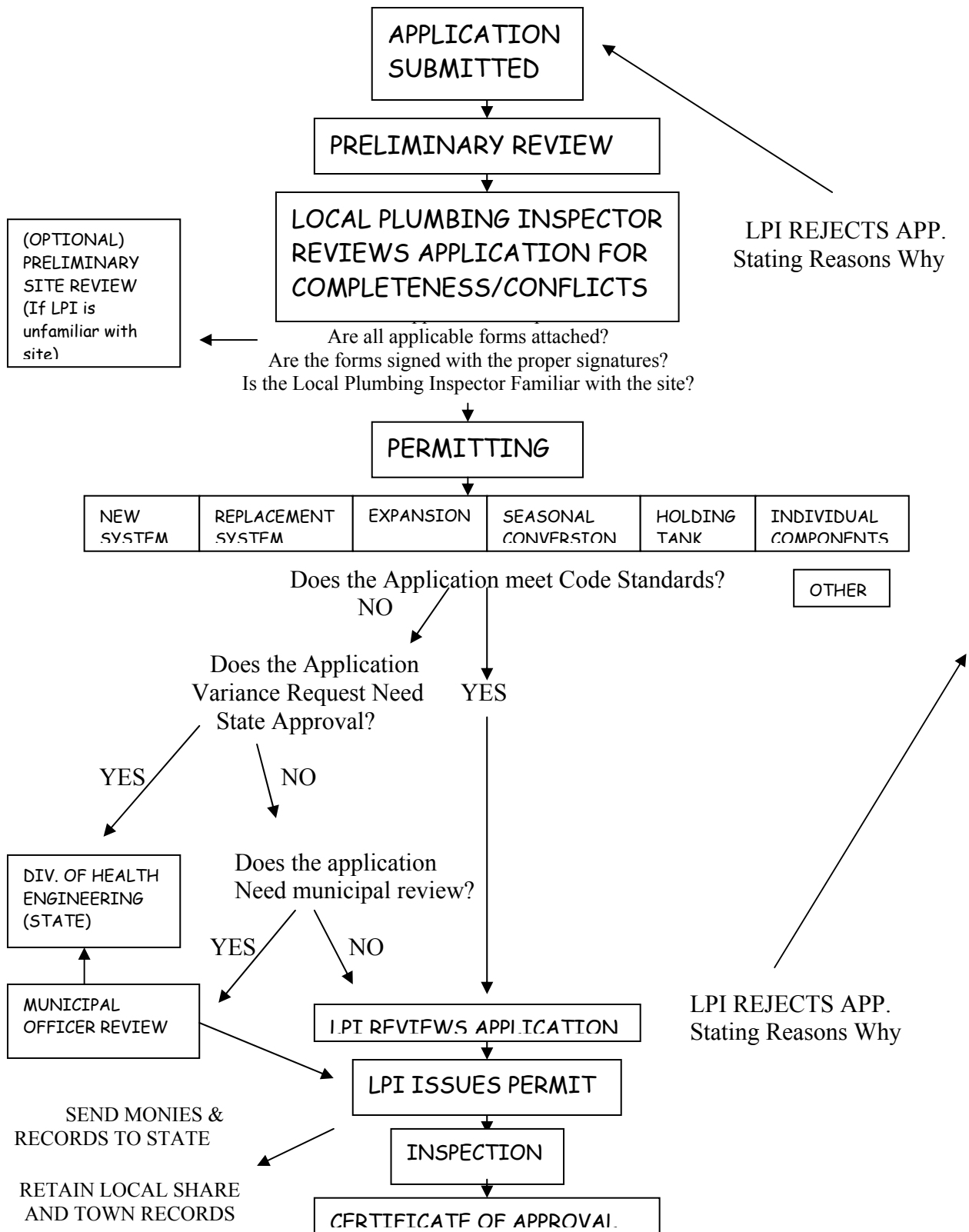


Figure 57. Flow Chart for Local Plumbing Inspectors for Permit Issuance.

SUBSURFACE WASTEATER DISPOSAL APPLICATIONS REQUIRING A VARIANCE TO THE RULES

The Subsurface Wastewater Disposal Rules provide design criteria to assure protection of the health and environment plus consumer protection of the investment. The Division of Health Engineering or the Town may grant variances to the requirements for new or replacement systems in specific instances.

REPLACEMENT SYSTEM VARIANCE

A malfunctioning subsurface wastewater disposal system constitutes a public nuisance and potential health hazard, by law, and therefore, must be corrected at the earliest opportunity. If possible, a malfunction must be corrected in compliance with the existing Subsurface Wastewater Disposal Rules. Often, it is not possible for a replacement system to be installed in accordance with the Rules since many dwellings were constructed prior to the stricter land use and subsurface wastewater disposal regulations of the 1970's. Small lots, severe soil limitations and close proximity to wells or waterbodies commonly present problems for total compliance with the current regulations.

If a replacement system cannot be installed in accordance with the Rules, it will require a Variance. The Local Plumbing Inspector in Maine towns has the authority to grant replacement variances when the setback distances and soil conditions are within the limitations specified on the Replacement System Variance Form (Figures 58 and 59). If the conditions are so severe that the requested variances exceed those that the Local Plumbing Inspector may grant, then it requires review by the Division of Health Engineering. Health Engineering, in some instances, may request that a deed covenant be placed on the property to warn prospective buyers of the limitations of the waste disposal system or perhaps limit the wastewater generation on site.

It is extremely rare when something cannot be worked out to abate a malfunctioning disposal system for an existing building with a recognized legal use. For some very severe situations, a holding tank becomes the only solution. However, holding tanks are only permitted as a last resort when there are no other alternatives. Health Engineering's policy is to make relatively generous concessions to get a reasonable on-site disposal system in order to avoid a holding tank. Generally, when it comes to design of replacement systems requiring a variance, the Site Evaluator is confronted with the situation of selecting the least undesirable system and location.

The Division of Health Engineering's practices regarding Replacement System Variances are as follows:

- If possible, a replacement system must be installed in compliance with the existing Rules.
- If not possible to install a replacement system in compliance with the Rules, a system and location must be selected that offers the best potential for adequate treatment.

- The setback distances to neighboring wells, property owner's wells and watercourses are considered to be the most important; especially neighboring wells. Since Health Engineering considers the setback distance to an existing neighboring well to be paramount, no variance will be approved to allow a system less than 100 feet unless the owner of the well signs a written release. The Division of Health Engineering will intervene in cases where an owner of a well refuses to release the right to a 100 foot separation distance when a malfunction disposal system must be corrected.
- A deed covenant may be required for very severe conditions to either limit wastewater generation or to warn prospective buyers of the limitations of the system.

NEW SYSTEM VARIANCE

A new system cannot be installed on a site that does not meet the minimum criteria for soil or setback distances without a variance approval by the Municipality, Local Plumbing Inspector and the Division of Health Engineering.

The Division of Health Engineering is very strict in maintaining the required setback distances to waterbodies and wells for new system siting. Well setback distances are considered paramount and reductions are not readily granted.

A set of criteria, considering soil, site and engineering factors, has been established to objectively consider the potential for land that does not comply with the minimum soil condition criteria.

The purpose of this set of criteria is to establish an objective rating of the land for on-site wastewater disposal by evaluating the density of the proposed development, extent of watershed, proximity to waterbodies, water supplies, land use zoning, type of proposed development, amount of wastewater, and engineering design specifications.

Criteria Table 9 is a tool to compare a site with standards. Land owners, Site Evaluators, and reviewers must appreciate the methodology and limitations of the system and use it intelligently. The Division of Health Engineering is of the opinion that a site that obtains a relative point assessment of 75 or more has soil, site and engineering factors that offer high potential for variance approval. A site with a relative point assessment below 50 does not have many redeeming characteristics to make it worthy for on-site sewage disposal.

A site with a relative point assessment between 75 and 50 has a moderate to low potential for approval. Distressful as it is to landowners and consultants, the state of the art and sophistication of the system does not allow Health Engineering to establish a definitive point value in this range that will assure approval or disapproval. Generally, the higher the point value, the greater the potential for variance approval. Health Engineering scrutinizes variance requests in this range and attempts to visit as many sites as practical. Since all of sites can not be visited by Health Engineering, the Division relies heavily on the professional discretion of the Site Evaluator.

REPLACEMENT SYSTEM VARIANCE REQUEST

THE LIMITATIONS OF THE REPLACEMENT SYSTEM VARIANCE REQUEST

This form shall be attached to an application (HHE-200) for the proposed replacement system which requires a variance to the Rules. The LPI shall review the Replacement System Variance Request an HHE-200 and may approve the Request if all of the following requirements can be met, and the variance(s) requested fall within the limits of LPI's authority.

1. The proposed design meets the definition of a Replacement System as defined in the Rules (Sec. 2006)
2. There will be no change in use of the structure except as authorized for minor expansions outside the shoreland zone of major waterbodies/courses.
3. The replacement system is determined by the Site Evaluator and LPI to be the most practical method to treat and dispose of the wastewater.
4. The BOD5 plus S.S. content of the wastewater is no greater than that of normal domestic effluent.

GENERAL INFORMATION

Town of _____

Permit No. _____ Date Permit Issued _____

Property Owner's Name: _____ Tel. No.: _____

System's Location: _____

Property Owner's Address: _____

(if different from above) _____

SPECIFIC INSTRUCTIONS TO THE: LOCAL PLUMBING INSPECTOR (LPI):

If any of the variances exceed your approval authority and/or do not meet all of the requirements listed under the Limitations Section above, then you are to send this Replacement System Variance Request, along with the Application, to the Department for review and approval consideration before issuing a Permit. (See reverse side for Comments Section and your signature.)

SITE EVALUATOR:

If after completing the Application, you find that a variance for the proposed replacement system is needed, complete the Replacement Variance Request with your signature on reverse side of form.

PROPERTY OWNER:

If has been determined by the Site Evaluator that a variance to the Rules is required for the proposed replacement system. This variance request is due to physical limitations of the site and/or soil conditions. Both the Site Evaluator and the LPI have considered the site/soil restrictions and have concluded that a replacement system in total compliance with the Rules is not possible.

PROPERTY OWNER

I understand that the proposed system requires a variance to the Rules. Should the proposed system malfunction, I release all concerned provided they have performed their duties in a reasonable and proper manner, and I will promptly notify the Local Plumbing Inspector and make any corrections required by the Rules. By signing the variance request form, I acknowledge permission for representatives of the Department to enter onto the property to perform such duties as may be necessary to evaluate the variance request.

SIGNATURE OF OWNER

DATE

LOCAL PLUMBING INSPECTOR

I, _____, the undersigned, have visited the above property and have determined to the best of my knowledge that it cannot be installed in compliance with the Rules. As a result of my review of the Replacement Variance Request, the Application, and my on-site investigation, I (**check and complete either a or b**):

☐ a. (☐ approve, ☐ disapprove) the variance request based on my authority to grant this variance. Note: If the LPI does not give his approval, he shall list his reasons for denial in **Comments** Section below and return to the applicant.

--OR--

☐ b. find that one or more of the requested Variances exceeds my approval authority as LPI. I (☐ recommend, ☐ do not recommend) the Department's approval of the variances. Note: If the LPI does not recommend the Department's approval, she shall state his reasons in Comments Section below as to why the proposed replacement system is not being recommended.

Comments:

LPI SIGNATURE

DATE

Figure 58: Replacement System Variance Request – Page 1

Replacement System Variance Request

VARIANCE CATEGORY	LIMIT OF LPI'S APPROVAL AUTHORITY						VARIANCE REQUESTED TO:	
SOILS								
Soil Profile	Ground Water Table						to 7" inches	
Soil Condition	Restrictive Layer						to 7" inches	
from HHE-200	Bedrock						to 12" inches	
SETBACK DISTANCES (in feet)	Disposal Fields (total design flow)			Septic Tanks (total design flow)			Disposal Fields	Septic Tanks
From	Less than 1000 gpd	1000 to 2000 gpd	Over 2000 gpd	Less than 1000 gpd	1000 to 2000 gpd	Over 2000 gpd	To	To
Wells with water usage of 2000 or more gpd or public water supply wells	300 ft [a]	300 ft [a]	300 ft [a]	100 ft [a]	100 ft [a]	100 ft [a]		
Owner's wells	100 down to 60 ft	200 down to 100 ft	300 down to 150 ft	100 down to 50 ft [b]	100 down to 50 ft	100 down to 50 ft		
Neighbor's wells	100 down to 60 ft [b]	200 down to 120 ft [b]	300 down to 180 ft [b]	100 down to 50 ft [b]	100 down to 75 ft [b]	100 down to 75 ft [b]		
Water supply line	10 ft [a]	20 ft [a]	25 ft [a]	10 ft [a]	10 ft [a]	10 ft [a]		
Water course, major - for replacements only, see Table 400.4 for major expansions	100 down to 60 ft	200 down to 120 ft	300 down to 180 ft	100 down to 50 ft	100 down to 50 ft	100 down to 50 ft		
Water course, minor	50 down to 25 ft	100 down to 50 ft	150 down to 75 ft	50 down to 25 ft	50 down to 25 ft	50 down to 25 ft		
Drainage ditches	25 down to 12 ft	50 down to 25 ft	75 down to 35 ft	25 down to 12 ft	25 down to 12 ft	25 down to 12 ft		
Edge of fill extension -- Coastal wetlands, special freshwater wetlands, great ponds, rivers, streams	25 ft [d]	25 ft [d]	25 ft [d]	25 ft [d]	25 ft [d]	25 ft [d]		
Slopes greater than 3:1	10 ft	18 ft	25 ft	N/A	N/A	N/A		
No full basement [e.g. slab, frost wall, columns]	15 down to 7 ft	30 down to 15 ft	40 down to 20 ft	8 down to 5 ft	14 down to 7 ft	20 down to 10 ft		
Full basement [below grade foundation]	20 down to 10 ft	30 down to 15 ft	40 down to 20 ft	8 down to 5 ft	14 down to 7 ft	20 down to 10 ft		
Property lines	10 down to 5 ft [c]	18 down to 9 ft [c]	20 down to 10 ft [c]	10 down to 4 ft [c]	15 down to 7 ft [c]	20 down to 10 ft [c]		
Burial sites or graveyards, measured from the down toe of the fill extension	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft		
OTHER								
1. Fill extension Grade - to 3:1								
2.								
3.								

Footnotes: [a.] Single-family well setbacks may be reduced as prescribed in Section 701.2.

[b.] This distance may be reduced to 25 feet, if the septic or holding tank is tested in the plumbing inspector's presence and shown to be watertight or of monolithic construction .

[c.] Additional setbacks may be needed to prevent fill material extensions from encroaching onto abutting property.

[d.] Additional setbacks may be required by local Shoreland zoning.

[e.] Natural Resource Protection Act requires a 25 feet setback, on slopes of less than 20%, from the edge of soil disturbance and 100 feet on slopes greater than 20%. See Chapter 15.

[f.] May not be any closer to neighbors well than the existing disposal field or septic tank unless written permission is granted by the neighbor. This setback may be reduced for single family houses with Department approval. See Section 702.3.

[g.] The fill extension shall reach the existing ground before the 3:1 slope or within 100 feet of the disposal field.

[h.] See Section 1402.10 for special procedures when these minimum setbacks cannot be achieved.

SITE EVALUATOR'S SIGNATURE _____ DATE _____

FOR USE BY THE DEPARTMENT ONLY

The Department has reviewed the variance(s) and (☐ does ☐ does not) give its approval. Any additional requirements, recommendations, or reasons for the Variance denial, are given in the attached letter.

SIGNATURE OF THE DEPARTMENT _____ DATE _____

Figure 59: Replacement System Variance Request – Page 2

Figure 60: FIRST TIME SYSTEM VARIANCE REQUEST

This form shall accompany an Application (HHE-200) for a proposed first time system which requires a Variance to provisions of the Subsurface Wastewater Disposal Rules. The local plumbing inspector shall not issue a permit for the installation of a first time subsurface wastewater disposal system requiring a variance from the Department of Human Services until approval has been received from them.

GENERAL INFORMATION		Town of _____
Permit No. _____	Date Permit Issued _____	
Property Owner's Name: _____	Tel. No.: _____	
System's Location: _____		
Property Owner's Address: _____		
(if different from above) _____		

VARIANCE CONDITIONS

The Department has the authority to vary the requirements of the Rules in accordance with Section 105.2 of the Rules CMR 241 if all the following criteria are satisfied:

- a. The variance request has the approval of the LPI.
- b. The Municipal Officials have indicated that the variance does not conflict with any local wastewater disposal ordinances.
- c. The variance request demonstrates that there is no practical alternative for wastewater disposal, such as access to public sewer or the potential for an easement.
- d. The proposed system does not conflict with any provision controlling subsurface wastewater disposal in the Shoreland Zone.
- e. The site offers potential for a system which will dispose of the wastewater with minimal threat to public health, safety, or welfare.
- f. The property owner has indicated an awareness of the variance and any limitations or added costs the proposed system may require.

SOIL, SITE AND ENGINEERING FACTORS FOR NEW SYSTEM VARIANCE ASSESSMENT

(SEE TABLES 2000.1-2000.10)

	CHARACTERISTIC	POINT ASSESSMENT
Soil Profile		
Depth to Groundwater/Restrictive Layer		
Terrain		
Size of Property		
Waterbody Setback		
Water Supply		
Type of Development		
Disposal Area Adjustment		
Vertical Separation Adjustment		
Additional Treatment		
TOTAL POINT ASSESSMENT (Sec. 2003.6)		

Minimum Points (Check one): Outside Shoreland-50 ☐ Inside Shoreland-65 ☐ Subdivision-65 ☐

<u>SPECIFIC VARIANCE REQUESTED</u> (To be filled in by Site Evaluator)	SECTION OF RULE
1. _____ 2. _____ 3. _____	
<u>SITE EVALUATOR</u>	
<p>When a property is found to be unsuitable for subsurface wastewater disposal for a First Time System Variance by a Licensed Site Evaluator, the Evaluator shall so inform the property owner. If the property owner, after exploring all other alternatives, wishes to request a Variance to the Rules, and the Evaluator in his professional opinion feels the variance request is justified and the site limitations can be overcome, he shall document the soil and site conditions on the Application. The Evaluator shall list the specific variances necessary plus describe below the proposed system design and function. The Evaluator shall further describe how the specific site limitations are to be overcome, and provide any other support documentation as required prior to consideration by the Department. (Use Additional Sheets, if needed)_____</p> <p>I, _____, S.E., certify that a variance to the Rules is necessary since a system cannot be installed which will completely satisfy all the Rule requirements. In my judgment, the proposed system design on the attached Application is the best alternative available; enhances the potential of the site for subsurface wastewater disposal; and that the system should function properly.</p>	
_____ SIGNATURE OF SITE EVALUATOR	_____ DATE

Figure 61: First Time System Variance

PROPERTY OWNER		
I, _____, am the <input type="checkbox"/> owner <input type="checkbox"/> agent for the owner of the subject property. I understand that the installation on the Application is not in total compliance with the Rules. Should the proposed system malfunction, I release all concerned provided they have performed their duties in a reasonable and proper manner, and I will promptly notify the Local Plumbing Inspector and make any corrections required by the Rules. By signing the variance request form, I acknowledge permission for representatives of the Department to enter onto the property to perform such duties as may be necessary to evaluate the variance request.		
_____	<input type="checkbox"/> SIGNATURE OF OWNER <input type="checkbox"/> AGENT FOR THE OWNER	_____ DATE

MUNICIPAL OFFICER(S) (Selectman, Councilman, Alderman, Mayor, Town Manager)		
We, the Municipal Officer(s) of _____ have reviewed this application and are aware that the applicant is applying for a First Time System Variance to the Subsurface Wastewater Disposal Rules because the proposed system does not meet all requirements of the rules. The proposed variance request <input type="checkbox"/> does <input type="checkbox"/> does not comply with all Municipal Ordinances relating to subsurface wastewater disposal.		
_____	_____ TITLE	_____ DATE

LOCAL PLUMBING INSPECTOR - Approval at local level		
The local plumbing inspector shall review all First Time System Variance requests prior to rendering a decision. I, _____, the undersigned, have visited the above property and find that the variance request submitted by the applicant does not conform with certain provisions of the wastewater disposal rules. The variance request submitted by the applicant is the best alternative for a subsurface wastewater disposal system on this property. The proposed system (<input type="checkbox"/> does <input type="checkbox"/> does not) conflict with any provisions controlling subsurface wastewater disposal in the shoreland zone. Therefore, I (<input type="checkbox"/> do <input type="checkbox"/> do not) approve the requested variance. I (<input type="checkbox"/> will <input type="checkbox"/> will not) issue a permit for the system's installation as proposed by the application.		
_____	LPI Signature	_____ Date

LOCAL PLUMBING INSPECTOR - Referral to the Department		
The local plumbing inspector shall review all First Time System Variance requests prior to forwarding to the Division of Health Engineering. I, _____, the undersigned, have visited the above property and find that the variance request submitted by the applicant does not conform with certain provisions of the wastewater disposal rules. The variance request submitted by the applicant is the best alternative for a subsurface wastewater disposal system on this property. The proposed system (<input type="checkbox"/> does <input type="checkbox"/> does not) conflict with any provisions controlling subsurface wastewater disposal in the shoreland zone. Therefore, I (<input type="checkbox"/> do <input type="checkbox"/> do not) recommend the issuance of a permit for the system's installation as proposed by the application.		
_____	LPI Signature	_____ Date

FOR USE BY THE DEPARTMENT ONLY		
The Department has reviewed the variance(s) and (<input type="checkbox"/> does <input type="checkbox"/> does not) give its approval. Any additional requirements, recommendations, or reasons for the Variance denial, are given in the attached letter.		
_____	SIGNATURE OF THE DEPARTMENT	_____ DATE

Note: 1. Variances for soil conditions may be approved at the local level as long as the total point assessment is at least the minimum allowed. (See Section 1902.0 for Municipal Review.)
2. Variances for other than soil conditions or soil conditions beyond the limit of the LPI's authority are to be submitted to the Department for review. (See Section 1901.0 for Department Review.) The LPI's signature is required on these variance requests prior to sending them to the Department.

HOLDING TANK APPLICATION

The holding tank application form is intended to be used when a subsurface wastewater disposal system that discharges septic tank effluent to the soil can not be designed for a property, due to severe site and/or soil limitations. Because of the cost associated with having a holding tank pumped regularly, and the difficulty in administering their proper use, they are generally only permitted for replacement systems when there is no other alternative. The Rules do, however, allow for holding tanks to be used for first time systems if they are small non-food service, commercial enterprises and there is no other alternative. Holding tanks may also be used for other first time systems, but only if the municipality has adopted an ordinance, similar to the one found in the appendices of the Rules, whereby the municipality assumes full responsibility for overseeing the maintenance of holding tanks. Holding tanks may not be used for first time systems within the shoreland zone area or for seasonal conversion purposes. The most common use of holding tanks is for seasonal dwellings where pumping may only be required once or twice a season and is therefore not cost prohibitive. Information contained on the holding tank application form includes; name and address of the applicant, property address, signature of owner, signature of the Site Evaluator, municipal officer signatures, signature of the LPI and a holding tank pumper agreement. The holding tank pumper agreement provides information about the pumper and requires the pumper's signature. The Rules also require a deed covenant when a holding tank is used for a disposal system. The Division of Health Engineering provides forms for that purpose.

APPLICATION/AGREEMENT for HOLDING TANK INSTALLATION

PROPERTY OWNER INFORMATION

Name _____
Mailing Address _____
City/Town _____ State _____ Zip _____ -
Daytime telephone number _____ - _____

PROPERTY LOCATION

Street, Road, Route _____
City/Town _____ Zip _____ -

APPLICATION FOR (check one)

- ☐ First Time Installation (If this is checked, give Town's **Ordinance** adoption date / /)
- ☐ First Time Installation, non-residential only, less than 100 gpd or 500 gal/week
- ☐ Replacing an existing overboard discharge, surface wastewater discharge or malfunctioning subsurface wastewater system
- ☐ Replacing an **existing** holding tank

CONDITIONS FOR APPROVAL

- * The installation of a conventional disposal system is not possible due to **unacceptable** site and/or soil conditions, lot configuration, or other constraints
- * Public sewer is not available.
- * All existing or proposed plumbing fixtures shall be installed or modified for water conservation and all water closets shall meet the Federal standard of 1.6 gallons per flush.

REQUIREMENTS FOR APPROVAL

- A Completed Application shall consist of:
 - * This form (HHE-233) completed with all signatures.
 - * A completed *Subsurface Wastewater Disposal System Application* (HHE-200) prepared by a Licensed Site Evaluator.
 - * Holding Tank Deeds Covenant Form, HHE-300 3/97
 - * Replacement System Variance Request Form, as necessary.

PROPERTY OWNER INFORMATION AND REQUIREMENTS

- I (we), _____ own the property described in this Application/Agreement.
1. Holding tanks require regular pumping by a licensed pumper. The owner must pay this service.
 2. The holding tank will be pumped at least once a year by the pumper listed on this application. Another pumper may be used if the listed pumper is notified and the LPI approves the change. The new pumper will then be listed on an attachment to this agreement.
 3. A water meter shall be installed at the owner's expense if required by the LPI.
 4. All records of pumping and water use (if required) must be kept for at least three years and shall be made available to the LPI or other official if requested.
 5. A holding tank for new construction can only be replaced by a system meeting first time system requirements.
 6. Once approved this form must be recorded at the Registry of Deeds, cross referenced to the owner's deed.
 7. We agree to comply with any additional requirements of the Town.

We state that all the information presented with this application is true and accurate, we acknowledge the foregoing items and agree to comply with all the requirements.

Property Owner(s) Signature _____ Date _____
Property Owner(s) Signature _____ Date _____

Figure 62. Holding Tank Form – Page 1

Application/Agreement for Holding Tank Installation

Owner _____ Property Location _____

SITE EVALUATION STATEMENT

I, _____, state that I have evaluated the subject property and found that a subsurface wastewater disposal system is not practical. Secondly, I have completed a *Subsurface Wastewater Disposal System Application* (HHE-200) proposing a holding tank installation for the property's wastewater disposal.

Site Evaluator's Signature _____ Date _____

HOLDING TANK PUMPER INFORMATION

Business owner's name _____ License # _____

Business name _____

Mailing address _____

City _____ State _____ Zip _____ -

Business telephone _____ - _____ - _____

Max. truck hauling capacity _____ gallons

Can pump: _____ seasonally _____ year round

DEP licensed disposal site location _____ Site # _____

HOLDING TANK PUMPER STATEMENT

I, _____, own and operate a septage pumping business named in this **Application/Agreement**, and have contracted with the property owner(s) to pump and properly dispose of the tank's waste. I further state that the tank, and that the wastewater will be disposed of at a Department of Environmental Protection licensed disposal location.

Holding Tank Pumper's Signature _____ Date _____

Municipal Officers Statement

I (we) have reviewed the information submitted in support of this application.

I (we) find that the installation of the holding tank will not violate any local ordinances.

I (we) will authorize the LPI to enforce the requirements of this agreement, the Subsurface Wastewater Disposal

Rules and any local ordinances, including recordkeeping and required pumping.

I (we) recommend that the LPI issue the necessary permits for the installation of the holding tank.

Signature _____ Title _____ Date _____

Signature _____ Title _____ Date _____

Signature _____ Title _____ Date _____

Local Plumbing Inspector's Statement

I have reviewed this application and find that the issuance of a permit for the holding tank complies with the Subsurface Wastewater Disposal Rules and all pertinent local ordinances.

Additional Requirements: _____

Signature _____ Date _____

Figure 63: Holding Tank Form – Page 2

Seasonal Conversion Permits: A completed page one of the HHE-200 form (with seasonal conversion checked off by the Local Plumbing Inspector) is required for issuance of a seasonal conversion permit. Owners of Seasonal dwellings with disposal systems located in the Shoreland Zone (i.e. within 250 feet of a classified water body) are required to obtain a Seasonal Conversion Permit prior to converting the dwelling to year-round use. The owner must demonstrate that the structure being converted has a disposal system installed in substantial compliance with the Rules. If the system is not in substantial compliance, one must be installed or the use of the dwelling will be restricted to seasonal use.

Additional Required Forms: In addition to the forms described above, permit applications occasionally require other forms such as:

- ❑ **Well Setback Release form:** This is required when a disposal system component such as a septic tank or disposal area must be installed less than 100 feet from an abutter's well and/or less than the setback distance of an existing disposal system, from an existing well. (see Figure 64)
- ❑ **Easement form:** This is required when a disposal system or component is installed on a property other than that of the applicant. They must be filed in the Registry of Deeds.
- ❑ **Future Disposal System Expansion form:** If an applicant is required to have a system designed in order to expand or for a change in use and doesn't wish to have the system installed at that time, the application and a cover document must be filed with the Registry of Deeds. In addition, all abutters must be notified by certified mail, of the intent to install the system at some future date including details of the planned location of the system. No abutter, so notified, may install a well that will prevent the installation of the system (Title 30-A Section 4211 3B).
- ❑ **Deed Covenant:** The Rules require a deed covenant to be filed in certain instances, before a permit can be issued. In addition, the Department may require the attachment of a deed covenant to a permit application before authorizing a permit to be issued. This is usually due to soil or site limitations. The covenant will spell out specific limitations as to the use of a property. (see Figure 65)

WELL SETBACK RELEASE FORM

We, the undersigned, are the owner(s) of the well and/or property herein described. We have read and understand the following information concerning the proposed separation distance between our well and the subsurface waste water disposal system for which a variance is being requested. We are prepared to accept any risk that the subsurface waste water disposal system may pose to our well.

All wells should be located a safe distance from all possible sources of contamination; in this case a subsurface waste water disposal system. The Maine Subsurface Waste Water Disposal Rules require a minimum of 100 feet between a <1000 gpd disposal system and a well; 200 feet between a 1000-2000 gpd disposal system and a well; and 300 feet between a >2000 gpd disposal system and a well with water usage of 2000 or more gpd or public water supply well. **(Please circle the appropriate category.)**

Since the safety of a well primarily depends on considerations of good well construction, geology and adequate maintenance of the subsurface waste water disposal system, the best means of protecting the well water quality is to maintain the maximum distance between a well and a disposal system. The Department of Human Services suggests that a maximum setback distance should be maintained.

The separation distance between our well and the subsurface wastewater disposal system for which this well release approval is requested is: component _____ / _____ feet.

component _____ / _____ feet

Address of Property with Disposal System: _____
(Include Municipal Book & Page No. or Map & Lot No.) _____

Owner(s) of Property with Disposal System: _____

Address of Property with Well: _____
(Include Municipal Book & Page No. or Map & Lot No.) _____

Owner(s) of Property with Well: _____

We, the undersigned, release the site evaluator, well driller, the municipality and the State of Maine from liability should our well become contaminated. (Note: If the subject well has more than one owner, all well owner signatures must appear on this document.)

Well Owner(s) Signature _____ Date _____

_____ Date _____

State of Maine

County of _____, ss _____ Date _____

Then personally appeared the above named _____ (and _____

_____) and (severally) acknowledged the foregoing instrument to be his

(or their) free act and deed.

Before me, _____
Justice of the Peace or Notary Public

HHE-306 Rev 10/01/02

Figure 64. Well Setback Release form

**SUBSURFACE WASTEWATER DISPOSAL SYSTEM VARIANCE
DEED COVENANT**

To Property Owner: Complete and record this form with your County Registry of Deeds. Afterward, submit a copy of the recorded covenant to the Local Plumbing Inspector and the Department of Human Services, Division of Health Engineering, State House Station #11, Augusta, Maine 04333-0011.

To County Registrar: Please cross reference by book and page number:
Book _____, Page _____.

Address of Property with Disposal System: _____
(Incl. Municipal Book & Page No.) _____.

Stipulations of Covenant:

The Department of Human Services and/or the Town of _____ has approved a Variance to the Maine Subsurface Waste Water Disposal Rules, 10-144A CMR 241, for the installation of a subsurface waste water disposal system subject to the implementation of the above conditions.

Signature _____ Date _____

Signature _____ Date _____

State of Maine

County of _____, ss. Date _____

Then personally appeared the above named _____

(and _____) and (severally) acknowledged the foregoing

instrument to be his (or their) free act and deed.

Before me, _____
Justice of the Peace or Notary Public

HHE-304 Rev 3/97

Figure 65: *First Time or Replacement System Variance Deed Covenant*

INSPECTION FORM (Contractor, Site Evaluator, Local Plumbing Inspector)

The Division of Health Engineering provides a subsurface wastewater disposal system information sheet when a system installation is to be verified by either the contractor, Site Evaluator or Local Plumbing Inspector (see Figure 66).



STATE OF MAINE
DEPARTMENT OF HUMAN SERVICES
11 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0011

JOHN ELIAS BALDACCI
GOVERNOR

PETER WALSH
ACTING COMMISSIONER

SUBSURFACE WASTEWATER DISPOSAL SYSTEM INFORMATION SHEET

System Owner's Name: _____

System Location (Street and Town): _____
(It is suggested that a copy of the Subsurface Wastewater Disposal System Application be retained with this document).

Site Evaluator: (Form to be completed by Site Evaluator)

Name: _____ S.E. License Number: _____ Date of Evaluation: _____

Brief Description of System: Design Flow: _____ gpd Number of Bedrooms: _____

Disposal Area Size: _____ Sq. Ft. Disposal Area/Proprietary Unit: _____
(Bed, Chamber, Other (specify))

Chambers: Type (plastic, concrete) _____ Number: _____

Septic Tank: Capacity _____ gal. Type (Concrete/Plastic) _____

Distance to System Owner's well from septic tank _____ ft. or disposal area _____ ft.

Distance to Neighbor's well from septic tank _____ ft. or disposal area _____ ft.

Site Evaluator's Statement: "I have reviewed the soils of this site and have determined that a subsurface wastewater disposal system can be installed in compliance with the Maine Subsurface Wastewater Disposal Rules (10 CMR 241). If a Replacement System, the disposal system is sited at a location to maximize the required allowable setback distances for a Replacement System.

Signature of Site Evaluator

Date

Contractor's Statement: "I have installed a subsurface wastewater disposal system at the above address as designed by the noted Site Evaluator. This system is installed as shown on the design prepared by the Licensed Site Evaluator".

Signature of Contractor

Date

Local Plumbing Inspector's Statement: "I have inspected the installation authorized as noted by the subsurface wastewater disposal system permit and found it to be in compliance with the Application and the Subsurface Wastewater Disposal Rules".

Signature of Local Plumbing Inspector

Date

Figure 66. Subsurface Wastewater Disposal System Information Sheet

The Local Plumbing Inspector must review and act upon an application for subsurface wastewater disposal within a reasonable time. Permit denials shall state the reason for denial in writing. Disposal system permits are **not transferable**; however, amendments to a disposal system may be made at any time before work on the system is complete. Such amendments are considered to be part of the original application and no additional fees can be assessed. The Local Plumbing Inspector can revoke a disposal system permit at any time if any false statements or misrepresentations of fact are discovered in the permit application or on the plans upon which the permit approval was based.

Permit fees must be collected by the Local Plumbing Inspector before a permit is issued. No work can be undertaken on a disposal system until the permit is issued. If work starts on a system prior to issuance of a plumbing permit, a double permit fee may be assessed.

INSPECTIONS

One of the primary responsibilities of the Local Plumbing Inspector regarding subsurface wastewater disposal systems is **inspections**. The purpose of inspections is to insure that disposal system installation is in compliance with the *Subsurface Wastewater Disposal Application* and the *Subsurface Wastewater Disposal Rules*. Ideally, the Local Plumbing Inspector would conduct several inspections, starting before any site alteration occurs and continuing throughout the construction process. Due to time and financial limitations, however, only two inspections are required by the *Subsurface Wastewater Disposal Rules*. One inspection shall be made after site preparation and prior to installation. The second inspection shall be conducted prior to covering the system. Most Local Plumbing Inspectors become familiar with the workmanship of Excavating Contractors in their area, and can schedule additional inspections beyond the minimum in order to obtain a comfort level that the system is being constructed properly.

The contractor/installer must notify the Local Plumbing Inspector at least 24 hours in advance of the need for the required inspection. If any part of the system is covered, it is up to the discretion of the Local Plumbing Inspector whether or not it should be uncovered before completion of the inspection. A certificate of approval is only issued if the system is found to be in compliance with the Rules. If the system does not comply with the Rules, the Local Plumbing Inspector must issue a written correction order to the installer that specifies what is required to bring the system into compliance and a reasonable deadline for completion of the correction.

Typical equipment required for inspections of subsurface wastewater disposal systems includes the following:

- A pop level or tripod mounted level
- A shovel for checking stone or fill
- A carpenter's folding rule or engineers surveying rod
- A 100 foot tape measure
- A scale for measuring distances on a disposal plan
- A two or three foot level
- A log book or journal
- A copy of the disposal system application
- A camera

Areas which the Local Plumbing Inspector should pay particular attention during inspection include:

Presence of reported elevation reference point

The Local Plumbing Inspector should examine page three of the subsurface wastewater disposal application (see Item #11 on Figure 39c) and find the reported elevation reference point described on the application. If a nail was utilized by the Site Evaluator, the established height of the nail above the existing ground is usually reported to prevent *tampering* with the nail and the proposed desired elevation of the disposal area. The height of the nail should be checked to.

Septic tank (location, integrity and size)

The Local Plumbing Inspector must confirm the size of the septic tank and assure that it is setback the proper distance from the structure as specified on the form. Additionally, it is important to assure that the inlet and outlet pipes are properly installed and adequately grouted. The pipes should have adequate spacing from the baffles to prevent blockage.

Sewer, effluent and distribution pipe pitches (if gravity)

All pipes utilizing gravity flow should have the pitch as specified on the plans or per the Code. It is the responsibility of the Local Plumbing Inspector to verify the pipe grades or levelness. The grades can be checked by measuring the drop in a pipe over the known length of pipe.

Water tightness of septic tank and pump station

It is very important for the Local Plumbing Inspector to assure that the septic tank and pump station, if utilized, is *water-tight*. Surface groundwater, if allowed to enter the septic tank during periods of heavy precipitation or high groundwater levels, can introduce large volumes of *extra* water to the disposal system and cause the disposal area to *fail*, with large volumes of wastewater surfacing.

All pipes and exiting septic tanks and pump stations should be properly grouted. The *bung* hole in the side or bottom of the septic tank should be sealed. The Local Plumbing Inspector should assure that risers and covers, if specified by the Site Evaluator, are included in the construction.

Distribution box

The Local Plumbing Inspector should check to make sure the distribution box was installed level. The contractor is responsible for adding clean water to the distribution box, if specified, so the levelness can be checked by assuring that the liquid level is at the bottom (invert) of all the outlet pipes at approximately the same elevation. If the outlet pipes are not level, flow equalizers should be added to rectify the problem. The insulation of the distribution box should be checked to make sure it is adequate to prevent freezing. All pipes entering and exiting the distribution box should be properly grouted.

Stone (size and *cleanliness*) if used

The Local Plumbing Inspector is responsible for making sure that proper stone is utilized, if specified in the plans. The proper size should be verified and also the Local Plumbing Inspector should examine for excessive fines.

Inclusion of all system components specified on subsurface wastewater disposal applications

The Local Plumbing Inspector is responsible to check for the proper proprietary leaching devices and components as specified in the plans. The Local Plumbing Inspector should verify the presence and quality of stone materials, if utilized, in conjunction with proprietary leaching devices. Even though proprietary leaching devices may look similar, not all are exactly the same size, or carry the same hydraulic loading rating. The Local Plumbing Inspector should take care to measure the height and size and compare to Table 14. If a proprietary leaching device is to be subjected to vehicular traffic, the leaching device must have an H-20 load rating. Care should be taken by the Local Plumbing Inspector to assure the devices used have the required load rating.

Backfill texture

The Local Plumbing Inspector should check to make sure the backfill used in construction of the system was proper. The backfill should be gravelly coarse sand with 3 to 8% fines. This material will look and feel like *sand*. The LPI should be able to see random gravel fragments in the soil. The backfill should feel *gritty* when rubbed with the fingers. When the backfill is handled and then dropped, the palms should reveal a small amount of *fines* in the creases of the skin.

Well setback distances

It is very important for the Local Plumbing Inspector to check well setback distances from neighboring wells to assure that the distances are accurate as specified on the plans.

Check for anything unusual

The Local Plumbing Inspector should make note of anything unusual, such as the presence of groundwater, compacted soil, erosion problems, etc. and discuss the issue with either the Site Evaluator or the Division of Health Engineering.

Elevation of disposal system

It is very important for the Local Plumbing Inspector to check the elevation of the disposal system. Commonly, the contractor will have a transit, level, and workers available during the LPI's inspection to assist with holding the rod, etc. The LPI should carry a hand level to check elevations if the contractor's equipment or workers are not available.

June 28, 2003

Mr. John Doe
Pleasantville, ME 04038

RE: Malfunctioning Septic System

Dear Mr. Doe:

On June 27, 2003 I inspected your wastewater disposal system located on property denoted on Pleasantville Tax Map 22, as lot 2.222. It was obvious that the disposal area is not functioning properly and needs to be corrected. It is necessary that immediate action be taken to correct this problem. As the system is in close proximity to a small stream, this further exacerbates the urgency for correction.

In order to bring this issue to a resolution, I must therefore order that you correct the situation within 20 days of receipt of this letter. Failure to comply with this order is a violation of State Statutes (Title 22 MRSA, Section 42 and Title 30-A MRSA, Section 3428) and could result in the municipal officers issuing an abatement order for correction. You would also be subject to penalties per 30-A MRSA Section 4452 if it became necessary to pursue a resolution in District Court. Please contact me at your earliest convenience, as a permit from this office will be necessary before you commence work.

I am enclosing a copy of Title 30-A MRSA, Sections 4452 and 3428 for your inspection. I hope that we can amicably resolve this issue in the time frame that I have imposed. If you have any question please do not hesitate to call.

Sincerely,

Joe Smith
Code Enforcement Officer
Local Plumbing Inspector

Cc: file
Enclosures

Figure 67: *Example of letter of notification of violation and order to correct*

ENFORCEMENT OF THE RULES

Maine Statute Title 22 MRSA, § 42 and Title 30-A MRSA, § 3428, gives the Local Plumbing Inspector the authority to order violations of the State of Maine Subsurface Wastewater Disposal Rules to be corrected. The minimum fine for any violation of the Rules is \$100, with a maximum of \$2,500 for each offense **(30-A MRSA § 4452)**. The municipality can utilize their own attorney to prosecute violators in court. Alternately, a Local Plumbing Inspector can be utilized, if certified by the State in Court Procedures (Rule 80K) and authorized in writing by the municipal officials, to represent the municipality in District Court. The Code Enforcement Officer Training and Certification Program offers certification and re-certification training programs for these procedures. Local Plumbing Inspectors should read the Code Enforcement Officers Training Manual on Legal Issues and Basic Enforcement Techniques for details on the process and outline of proper procedures. A sample letter of notification of a violation and order to correct is shown in Figure 67.

RECORD KEEPING

It is the responsibility of the Municipality to keep records of permits, issued by the Local Plumbing Inspector, for public access. This information is very important when properties with existing structures, which have subsurface wastewater disposal systems, are being sold. Records should be kept as long as the system is in existence. Retrieval experience by municipalities has shown that filing of these records is best done by correlating with tax map and lot number, not alphabetically or chronologically.

V. DISPOSAL SYSTEM INSTALLATION AND CONSTRUCTION

SNYOPSIS:

This chapter discusses installation practices and should be of particular interest to the excavating contractor, local plumbing inspector, and site evaluators, while providing background information to the regulatory, planning board members and property owners.

TOPICS:

Familiarity with *Subsurface Wastewater Disposal Rules* and specifications, Dig Safe, permits, installation, suitable weather and soil moisture conditions, site preparation, inspection, soil erosion and sediment control, clearing, septic tank installation, risers and covers, fill, piping, insulation, pump station, electrical wiring.

FAMILIARITY WITH SUBSURFACE WASTEWATER DISPOSAL RULES, SPECIFICATIONS, SPECIFIC SITE AND PROPOSED DESIGN

Excavating contractors should be knowledgeable with pertinent sections of the *State of Maine Subsurface Wastewater Disposal Rules* regarding disposal system components and installation techniques prior to attempting the construction of a disposal system.

The excavating contractor should visit the site several days prior to beginning construction so that he or she can become familiar with the site and the proposed design of the Site Evaluator. The contractor should be absolutely clear, after examining the plans, where the disposal area is intended to be constructed. Initial and final grades, based upon depth of fill required, should be relatively close to the proposed elevation of the system. If uncertain of any aspect of the plan, he or she should call the designing Site Evaluator prior to initiating work.

DIG SAFE

DIG SAFE HOT LINE (1-800-225-4977) should be called prior to any excavation by power equipment. **DIG SAFE** will send a representative to the project site to mark the location of underground utilities. Contractors should call DIG SAFE at least 72 hours before any excavation is done, except in an emergency. Recognized emergency situations can be called the day of the excavation. Failure to notify DIG SAFE could result in liability, if damage is done to underground utilities.

PERMIT

The excavating contractor should coordinate with the property owner, applicant, or client, to determine who is responsible for obtaining the permit to install the complete disposal system or individual component.

The property owner is ultimately responsible for assuring that a permit was obtained. Ideally, the permit should be secured well in advance. This will provide adequate time to resolve any problems that may arise. The excavating contractor should not commence construction until after seeing a valid subsurface wastewater disposal system permit and any attached condition of approval, if applicable.

INSTALLATION

Suitable Weather and Soil Moisture Conditions

Ideally, a subsurface wastewater disposal system should only be installed during suitable weather and soil moisture conditions. The Local Plumbing Inspector may deem conditions too wet to install a system.

A simple field test can be performed to determine if the soil condition is too wet for working. When a clump of soil, taken from the depth of the excavation, can be rolled out with the fingers to form a wire or rod 1/8" in diameter and does not crumble when handled, the soil moisture content is too high to proceed under normal circumstances.

Additionally, if possible, disposal areas should not be installed in frozen ground or when air temperatures are below freezing, especially if construction will take place over several days.

SITE PREPARATION

Site preparation varies somewhat, depending on whether portions of the proposed system are to be installed above or below the existing grade.

Soil Erosion and Sediment Control

Provisions should be made for stabilizing any soil disturbed during construction of a subsurface wastewater disposal system, particularly if the system is located adjacent to a water body, wetland, steep slopes, or in an otherwise sensitive area. An erosion and sediment control plan or specific measures may be necessary to comply with state or local permits for construction on some sites. Stabilization can be accomplished by any number of means, such as paving, mulching, use of geotextiles, etc. The most common method is by seeding and mulching. The appropriate fertilizer and seed mixtures should be specified as well as mulching requirements (such as tacking down). In addition, temporary erosion and sediment control measures such as staked hay bales or silt fence may be advisable for sensitive areas. (See *Maine Erosion and Sediment Control Handbook for Construction, Cumberland County Soil and Water Conservation District, 1991*).

Clearing

Forested Sites:

All trees and shrubs should be cut and all stumps removed from the area directly beneath the disposal area and within the proposed fill extensions. Generally, all trees and shrubs that will be exposed to significant fills must be removed. Special trees that are desired and are located toward the outside limits of the fill may be left if fill depth is minor. It is recommended that the Site Evaluator and Local Plumbing Inspector be consulted regarding removal of any particular trees in question.

Field Sites:

Field sites do not need to have trees and shrubs removed, but do need to have hay or tall grass cut and removed. If not done, the grass or hay will be compressed and form a mat which will impede wastewater from reaching the underlying soil. If there are any agricultural underdrains, they should be removed from underneath the disposal area and fill extension. Ideally, field sites, after removing the vegetation, should be harrowed, plowed or rototilled to prevent matting and open the soil for effluent infiltration. Plowing or disking should be done along the contour.

SEPTIC TANK INSTALLATION

Septic tanks are available in monolithic (one piece) or standard (two piece) tanks. Monolithic tanks are less likely to leak than standard two-piece tanks. Care should also be taken to plug the small diameter hole in the bottom or side of the tank (commonly referred to as a *bung hole*). This hole is provided to counter floatation in wet locations. This hole should be permanently sealed, immediately after the tank is in place, with grouting or other acceptable material for underwater use.

Risers and Covers

Openings surrounding inlet and outlet pipes should be permanently sealed with grout or the provided gasket to prevent ground water infiltration and wastewater leakage. The inspection covers and cleanout covers of septic tanks installed in wet areas must be installed with risers and covers above the seasonal high ground water table or to the ground surface. The seams between the riser barrel and septic tanks must be properly sealed to prevent ground water infiltration.

The location of all covers, not projecting above the ground surface, should be located with swing ties from the existing building so the septic tank cleanout cover can be located easily in the future for pumping. A record of these distances should be given to the homeowner for the home files. The Code also requires all covers to have rebar attached in an X shape, so a metal detector can be used to locate the cover.

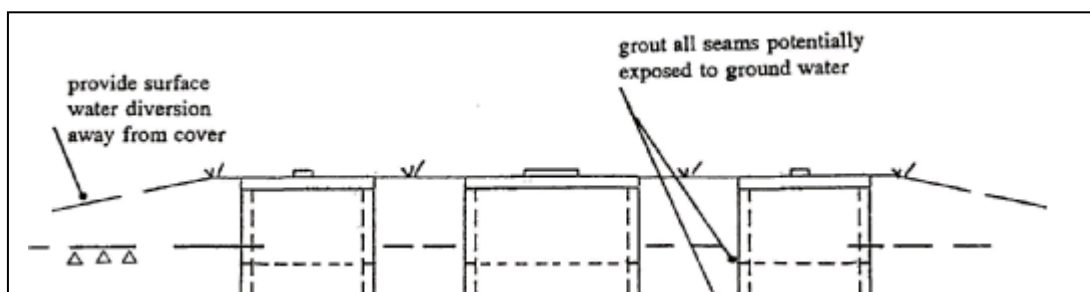


Figure 68. *Septic tank installation*

DISPOSAL AREA INSTALLATION

Fill

All fill used beside or beneath a subsurface wastewater disposal area must be gravelly coarse sand with approximately 4% to 8% fines, passing a #200 sieve, approximately 15% to 30% gravel and no more than 2% clay. This texture has been determined to provide the best combination of permeability and treatment. If the fill material contains a greater percentage of fines, its hydraulic capacity is decreased. If the fill contains fewer fines, then it does not provide adequate treatment of the effluent. Fill directly over the disposal area should be sandy loam or coarser, as specified on the disposal plan. A minimum of 4 inches of top soil equivalent (any soil material with a sufficient content of fines and organic matter to support growth of vegetation for a suitable seed bed) should be applied to disturbed soil surfaces.

Preparation for a proposed system to be installed below existing grade

If a portion of the system is to be installed beneath the existing grade, then the area of the proposed disposal system site should be excavated to the proposed elevation of the bottom of the disposal area. In addition, if the fill material is finer in texture than the original soil, a minimum of 4 inches of gravelly coarse sand backfill should be **rototilled** or thoroughly mixed with the teeth of a backhoe into the existing top soil layer to create a transition layer.

The final grade of the bottom of the disposal area should be scarified and leveled by raking with a hand tool rake or alternatively, with the teeth of the backhoe. Care should be taken to avoid

smearing or compaction of the soil while directly crossing the area with heavy equipment, once it has been scarified and leveled.

Preparation for a proposed system to be installed above ground

The area under the absorption field and fill extensions should be scarified by cultivating to a depth of 6 inches. Ideally, this is done by rototilling, plowing or disking to produce an un-vegetated roughened surface. If a plow is used, then the plow furrow direction should be perpendicular (across) to the slope. Alternatively, the teeth of the backhoe can be utilized. In addition, if the fill material is coarser in texture than the original soil, then a minimum of 4 inches must be mixed into the existing top soil layer to create a transition layer. Backfill should be placed in approximately 8 inch lifts and compacted by making a few passes with a bulldozer or excavator.

Stone or Proprietary Leaching Device Installation

Clean stone or proprietary devices (chambers, etc.) should be installed on the prepared soil surface, as outlined above. Care must be taken to avoid any actions that may cause smearing or compaction of the prepared surface. Make certain stone or gravel does not feather to the fill extension edge because it will cause the effluent to breakout onto the ground surface at these points if insufficient fill is utilized. The prepared soil surface must be at the elevation specified on the subsurface wastewater disposal system application and must be level, to within one inch. Do not level the disposal area with stone or gravel because this will cause effluent to pond in one or more parts. The disposal area bottom area must be leveled with suitable fill material as outlined above. Stone, if used, must be clean and of uniform size, between $\frac{3}{4}$ to 2 $\frac{1}{2}$ " diameter. Using stone of various sizes decreases available pore space and reduces holding capacity.

Rows or Trenches:

When installing rows or trenches, it is important to maintain a minimum of three feet of undisturbed original soil or suitable fill material between stone or proprietary leaching devices, to avoid the wastewater from one row directly impacting the downhill neighboring row. This is especially important when serial distribution is used.

Proprietary Leaching Devices:

Proprietary leaching devices have product specific installation requirements. The installer should be familiar with proprietary leaching device manufacturer's requirements prior to installing a disposal area which specifies their use.

Fill Extensions

Fill extensions associated with disposal area must be installed in accordance with the permitted application. The finished fill extension slope gradient can be determined by one of several methods:

- 1) Level and tape measure
- 2) Direct measurement using any abney level or clinometer
- 3) Measuring the difference in elevation between the top and toe of fill and then dividing by the measured length of fill.

Example:

Top of fill = Rod reading of 5.0'

Toe of fill = Rod reading of 10.0'

Length of fill = 20'

$10' - 5' \div 20' = 5 \div 20 = 0.25 \text{ or } 25\%$

Fill extensions should be constructed of materials meeting the requirements of backfill, as specified in the Code. Fill extensions should be comprised of backfill, free of foreign materials and large stones. The soil surface should be suitable for establishing a seed bed and be stabilized to prevent erosion.

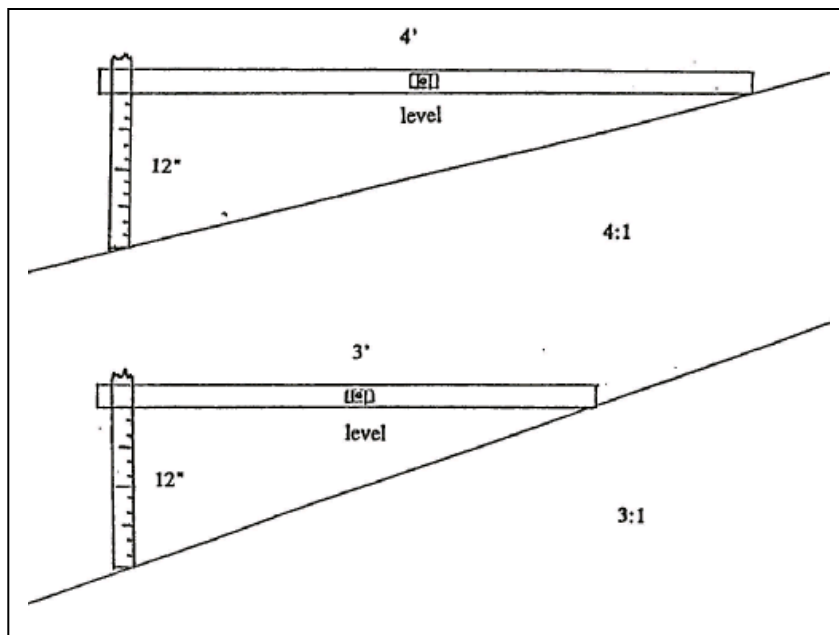


Figure 69: *Method of checking fill extension.*

Piping

Piping should be of approved materials as specified on the plans and the Rules. The soil material below all proposed gravity pipes should be properly compacted with a tamper prior to installation to assure a firm bed for maintaining the installed pitch of the pipe. Gravity piping that is to be installed under areas exposed to vehicular traffic should be of materials suitable for the exposed weight of the traffic (Schedule 40, SDR 35, etc.). All piping joints should be permanently connected and sealed to prevent leakage.

Insulation

The disposal system should be constructed to prevent freezing during periods of extended cold weather. Generally, freeze-up problems occur in locations where wastewater ponds in shallow pipes that are exposed to cold temperatures. Usually problem areas within systems are found in shallow uninsulated distribution boxes, long building sewer and effluent lines that have insufficient pitch, piping that exists under pavement, or in pressure effluent lines that were neither installed below frost (4 to 6 feet), properly insulated, nor provided with check valve drainage).

Insulation comprised of 2" thick, high density rigid polystyrene is commonly used for underground insulation. White bead board is not acceptable because it deteriorates with exposure to moisture.

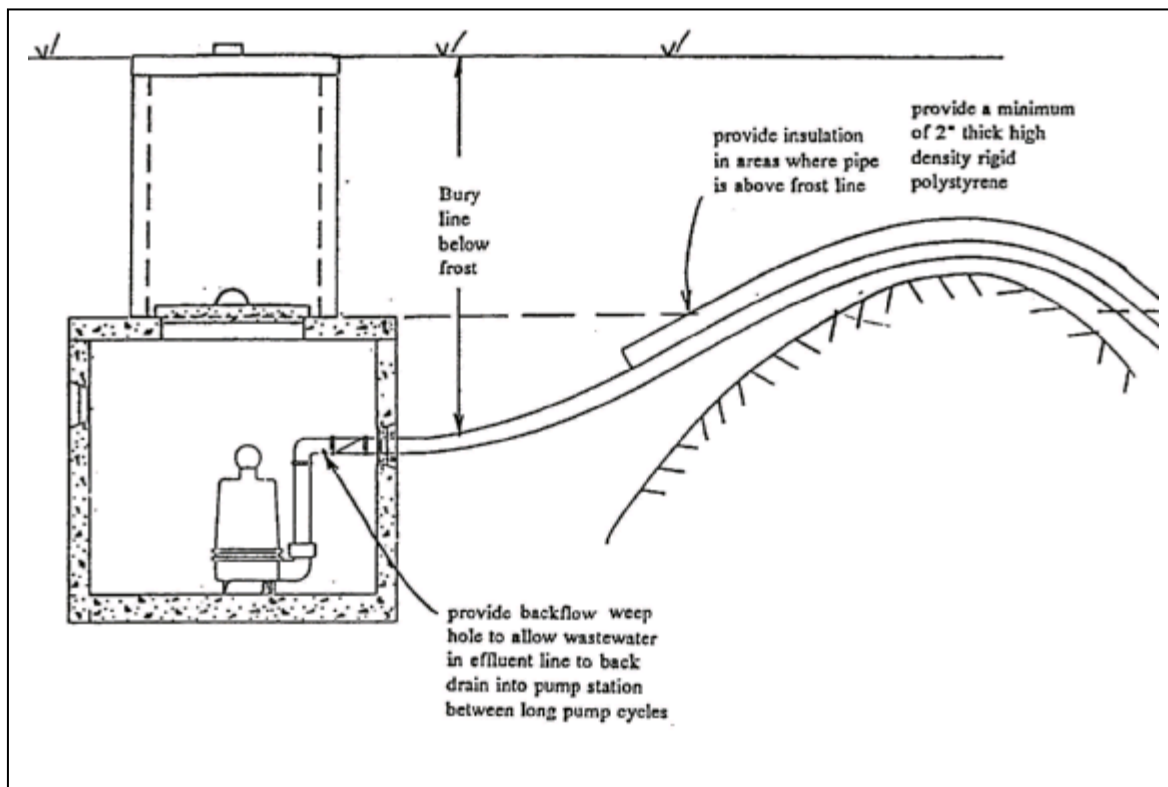


Figure 70. *Insulation of piping*

Pump Station

Pump stations require care similar to septic tanks with regards to preventing ground and surface water infiltration. Risers and covers should extend to the ground surface for ease of maintenance. Electrical power lines suitable for underground use should be a minimum of 18 inches below grade and buried below a marker tape (electrical line caution) or installed in a conduit pipe. Pumps and pump chambers must be sized in accordance with the Code and permitted applications. Pumps should be located on a pedestal within pump chambers so that they do not pump solids that may accumulate in the bottom of the pump chamber. When septic tanks are pumped during regular maintenance, pump chambers should also be pumped, to remove solids.

Electric Wiring

All electrical work must be installed per National Electrical Code by a licensed electrician or by a qualified homeowner.

Sewage is quite corrosive to electrical connectors. All electrical contacts and relay should be located outside the pump station (above ground next to foundation or direct burial). It is recommended that non-oxidizing grease be applied to all connectors located in the pump station. A gas-tight seal should be provided on any electrical conduit pipe entering the pump station.

INSPECTION

The Local Plumbing Inspector (LPI) must be notified when a disposal system is ready for inspection. Ideally, this Local Plumbing Inspector should be given as much notice as possible.

After the Local Plumbing Inspector approves the system installation, it should be properly covered and stabilized as specified by the plans and/or Rules.

CONTRACTOR / DISPOSAL SYSTEM OWNER RELATIONS

The contractor should supply the property owner with an accurate record of swing ties from installed cleanout covers to building corners, in order for future ease of maintenance.

Additionally, the homeowner should be provided with written instructions on proper maintenance of the disposal system.

VI. OWNER'S RESPONSIBILITIES

SYNOPSIS:

This chapter provides basic guidelines for operation of a subsurface wastewater disposal system, and should be of particular interest to property owners and provide background information to others.

TOPICS:

Care and maintenance of septic tank, pumping of septic tank, care and maintenance of disposal area.

Not only do the septic system designer, installer and inspector have responsibilities regarding a disposal system, so does the system owner. Failure of any of these parties, including the owner, to recognize and carry out their responsibilities can result in disposal system failure. The following is a listing of the minimum responsibilities an owner has regarding subsurface wastewater disposal systems.

MAINTAINING SUBSURFACE WASTEWATER DISPOSAL SYSTEM

Care and Maintenance of Septic Tank

The septic tank is an essential part of your subsurface wastewater disposal system. Proper care and maintenance of your septic tank protects the disposal area and will help prolong the life of the disposal system

- A “starter” is not necessary to stimulate bacterial action in a septic tank. The bacteria present in the domestic wastewater are adequate for bacterial action and will thrive under normal use.
- The **U.S. Environmental Protection Agency** and the **Maine Department of Human Services, Division of Health Engineering** both discourage the addition of septic tank additives. Septic tank cleaners containing *halogenated hydrocarbon* compounds are prohibited in Maine (38 MRSA 1602).
- Practice water conservation methods whenever possible.
- Normal amounts of household detergents, bleaches, and cleaners may be used without stopping the biological activity in the septic tank. Excessive amounts of any cleaners should not be used. Discharging solvents, paints, fuels, oils, hazardous or special waste into the tank is prohibited by laws and regulations.

- Avoid disposing of greases, fats, coffee grounds, disposable diapers, feminine napkins or other non-decomposable materials into the septic tank.
- Use of a garbage disposal increases the organic loading rate into a septic tank. Additional capacity or a septic tank filter is required.
- Avoid shock loading or doing excessive loads of laundry in rapid succession. Space the loads out over time to allow for a *rest* period between loads.

Pumping of the Septic Tank

Your septic tank should be pumped every 3 to 5 years, or as needed according to the actual use of the system, to remove accumulated solids for final disposal in an approved facility. The inlet and outlet baffles should be inspected with each pumping and replaced if necessary. The pumper should access the septic tank from the cleanout cover in order to allow pump hose to access the entire sludge bottom.

The homeowner should keep a record in the home file of swing ties from the building corners to the access cleanout cover for ease of maintenance. This should be provided to septic tank pumper.

Care and Maintenance of the Disposal Area

- Do not drive over your disposal area with automobiles, trucks, or heavy equipment unless your disposal area is specifically designed for these loads.
- Maintain adequate vegetation or mulch over the disposal area unless the field has been designed under pavement.
- Avoid siting gardens over disposal areas because annual rototilling tends to erode the surface cover. Rototiller tines can cut into the disposal pipes and units.
- Avoid tying dogs, which are inclined to dig, over disposal areas. Avoid siting horse or cattle corrals over fields due to foot impact and erosion potential.
- Vegetation with aggressive shallow root systems should not be grown near systems (willow trees, for example).

VII. SPECIAL CONSIDERATIONS

SYNOPSIS:

This chapter discusses more advanced and specific problems that should be of particular interest to individuals practicing in the field as Site Evaluator, Local Plumbing Inspector, Realtor, and owner of a disposal system. This section includes more advanced discussion of various commonly encountered problems or situations.

TOPICS:

Problem soils, wetlands, ground water monitoring, curtain drains, groundwater impact analysis, regulations, flood plains, coastal sand dunes, inspection reports, multi-user systems, malfunctions.

PROBLEM SOILS

The typical procedures for determining soil profile and drainage class are described in Chapter III, *Soil Evaluation*. In most instances, those procedures are adequate for making proper soil profile and drainage class determinations. There will be occasions however, when soils are encountered in which standard concepts will not lead to the correct identification of the soil profile or drainage class. These are generally referred to as *Problem Soils*.

Soil Profiles

Soil Profiles are classified by observing the number, type and sequence of soil horizons along with an evaluation of soil texture, structure, consistency, color, depth, and parent material. Typical soil profiles are found in Table 7. Soils, which do not have typical profiles, include the following:

Recent Alluvial Soils

These soils are so young, geologically, that no soil horizon development may be present. They can generally be distinguished from other soil profiles in their location (near a river or stream) and particle size, which were sorted by water (mostly fine sand and silt without stones).

Multiple Parent Materials

Occasionally, a soil profile will consist of more than one parent material within the 48" depth typically observed. Soil Profile 7, from Table 7, is the only recognized mixed origin soil in the *Subsurface Wastewater Disposal Rules*. There are, however, other mixed origin soils which do not fall within the parameter of Table 7. When designing disposal areas for these mixed origin

soils, the Site Evaluator must use common sense and base the design upon the soil profile from Table 7 that best describes the soil.

Disturbed Soils

Disturbed soils, which may cause difficulty in determining a soil profile, are generally those that have been filled or plowed, or have had upper soil horizons removed. **Cut soils** can usually be identified by the absence of typical horizons for the type of parent material observed. **Filled Soils** can often be recognized by the observance of buried horizons typically found near the surface, the presence of man-made objects, and unexplained contrasts between the fill material and native parent material below.

Soil Drainage Class Determination Problems

Soil drainage class is usually determined by observing soil morphological features, especially the presence or absence of drainage mottles. Less frequently, soil drainage class is determined by groundwater monitoring. Problem soils include those soils found at high elevations or along the immediate coast, glacial tills on long slopes, soils that have been plowed or disturbed and sandy soils, all of which may not exhibit drainage mottles consistent with seasonal water table depths. For these soils, other indicators of seasonal wetness must often be used, such as thickness of the surface organic horizon (thicker horizons often mean wetter soils), matrix color of soil horizons (darker and deeper surface mineral soil horizons also usually indicate wetter soils), variable shades of color in the **B** horizon, cemented **B** horizons and organic streaking in the **B** horizon, indicating fluctuation in water table.

Cool Climate Soils

Soils at high elevations or along the northern Maine coast form in much cooler environments than at lower elevations or further inland. Therefore, biologic activity within the soil, necessary for drainage mottle formation, is greatly reduced. Some high elevation soils in Maine may be so cool that biologic activity only occurs within the organic matter horizon.

Glacial Till Soils on Long Slopes

Glacial till soils on long slopes may be saturated during the growing season, but because the groundwater is moving within them and is not stagnant, reducing conditions may not be present. In such instances, drainage mottles will not form because microorganisms can get oxygen from the water. Usually these soils exhibit a buildup of organic matter within the soil.

Plowed or disturbed Soils

Soils that have been plowed, particularly thick plowed horizons (AP) may not exhibit drainage mottles within the plowed horizon due to masking by the organic matter. However, plowed or disturbed soils that are not saturated may exhibit mottles that are a result of mixing of soil horizons. Soils with thick **A** or **Ap** horizons should be evaluated for drainage class by using

other tools such as the *Maine Association of Professional Soil Scientists Key to Soil Drainage Classes*.

Coarse Textured Soils

Coarse textured soils lack fine soil particles that most readily exhibit effects of reduction (low chroma mottles). These soils may not appear mottled, when in fact they are seasonally saturated.

Coarse textured soils in poorly drained situations may develop reddish or blackish cemented layers that are the result of iron, aluminum, or organic matter, precipitating out at the depth of the seasonal water table. Cemented layers may create a perched water table above them and should not be mistaken for well drained, oxidized colors.

WETLANDS

Wetlands are areas that are inundated or saturated by surface and/or groundwater at a frequency or duration sufficient to support vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, bogs, marshes, wet forests, meadows and similar areas.

Wetland Criteria

In order for an area to be classified as a wetland it must meet three criteria:

- 1) It must have **hydric soils**,
- 2) Evidence of **hydrology** must be present, and
- 3) It must have or be capable of supporting, under normal circumstances, **hydrophytic vegetation**.

Hydric Soil is a soil that, in its undrained condition, is saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation. In Maine, soils which are classified as poorly or very poorly drained are considered hydric. The U.S.D.A. Soil Conservation Service has developed a list of soils meeting hydric soil criteria. That list can be obtained from any of the local Soil and Water Conservation District offices found in the State.

Hydrology is defined as permanent or periodic inundation or soil saturation to the surface, at least seasonally. It is the driving force behind wetland formation but it is also commonly the most difficult to establish in the field due to annual, seasonal or daily fluctuations. Field indicators of wetland hydrology include:

- Visual observations of inundation
- Visual observations of soil saturation
- Water marks on woody vegetation in flood prone areas
- Drift lines
- Water borne sediments
- Surface scoured areas

Hydrophytic Vegetation is defined as macrophytic plant life growing in water, soil or on substrata that is at least periodically deficient in oxygen as a result of excessive water content. The U.S. Fish and Wildlife Service, in cooperation with the Army Corps of Engineers, EPA and the Soil Conservation Service have published the “National List of Plant Species the Occur in Wetlands”. This list separates vascular plants into four basic groups, commonly called “wetland indicator status” based upon a plant species frequency of occurrence in wetlands. These groups are defined below.

Wetland plant groups

Obligate Wetland Plants: greater than 99% probability of being found in Wetlands under natural conditions.

Facultative Wetland Plants: likelihood of being found in wetlands is 67% - 99%, under natural conditions.

Facultative Plants: this group of plants is equally likely to be found in wetland and non-wetlands under natural conditions.

Facultative Upland Plants: likelihood of being found in non-wetlands is 67% - 99% under natural conditions.

The Maine Fish and Wildlife service has a list of those plant species that are native to Maine.

Wetland Jurisdiction

The Army Corps of Engineers (ACOE) makes jurisdictional determinations and issues wetland permits for filling, dredging, and other construction resulting in alterations on certain wetlands under Section 10 of the Rivers and Harbors Act of 1899. The ACOE provides the same function under Section 404 of the Clean Water Act for all other wetlands, with program oversight by the U.S. Environmental Protection Agency (EPA). With the combination of these two acts, activities within all wetlands, regardless of size, are regulated by EPA and the Army Corps of Engineers. The Maine Department of Environmental Protection regulates activities in or adjacent to coastal or freshwater wetlands, as defined in Chapter 2 of the Natural Resources Protection Act, Title 38 M.R.S.A Sections 480-A through 480-U.

Wetland Delineations

Identification and Delineation of Wetlands must be made in accordance with the applicable regulatory agency requirements. Since those requirements frequently change, it is best to consult the appropriate agency(s) periodically for the latest guidance or requirements. For more information on wetland delineation criteria, contact the U.S. Army Corps of Engineers in Augusta, Maine, for federal regulations or the local regional office of the Maine Department of Environmental Protection for the state regulations or the local municipality for local ordinances.

GROUNDWATER MONITORING

When determining the seasonal high water table, soil morphological features are typically used. Occasionally, there is reason to believe that soil morphological features associated with wetness are not an accurate indicator of seasonal water table. In such instances, groundwater monitoring is a useful tool to verify seasonal water table depth.

Correlation with Soil Morphological Features

Since the standard procedure for determining soil suitability for subsurface wastewater disposal is observance of soil morphological features associated with wetness, the groundwater monitoring observance period should reflect the time period when those features normally develop. That is, when the soil, at a depth of 20" below the mineral soil surface, is at or above 41°F.

The time in the spring in Maine when soil temperatures reach this temperature is the start of the growing season (generally considered May 1 in most parts of Maine except for northern and higher elevations).

Monitoring Well Installation

In order for a groundwater monitoring well to function properly, it must be installed so that groundwater can freely enter, while at the same time preventing the entry of surface water. Depth of the monitoring well should be at least 36" below the mineral soil surface, for permeable soils. For soils with restrictive horizons, at least one of the monitoring well should be installed so that it does not extend through the restrictive horizon. This is to determine perched, seasonal water table presence and depths.

For soils where attempts have been made to lower the seasonal water table by use of a curtain drain or diversion ditch, at least one monitoring well should be placed above and one below the drain or ditch to determine its effectiveness.

*Additional details on groundwater monitoring can be found in the *Subsurface Wastewater Disposal Rules*.

Curtain Drain Installation

Curtain drains are an effective measure to lower the seasonal water table, in certain instances. They include friable topsoil, underlain by impervious subsoil, where the contributing upslope drainage area is sufficient to create a perched, seasonal water table. Soil profiles, where curtain drains are generally the most effective, are profiles 1, 3 and 7. They may also be appropriate for soil profile 8, where the topsoil contrasts with the subsoil; and profile 5 where a cemented horizon is present. The *Subsurface Wastewater Disposal Rules* provides additional specifications on design and installation of curtain drains.

GROUNDWATER IMPACT ANALYSIS

Groundwater Mounding Analysis

Groundwater mounding is the raising of the groundwater table within a certain area by the application of an increased volume of water to that area. Mounding probably occurs beneath all subsurface wastewater disposal areas to some degree, but does not generally become a problem until large volumes of wastewater must be disposed of in a limited area. In general, sites where large volumes of wastewater are proposed are the ones that have the greatest potential for groundwater mounding and which should have a groundwater impact analysis.

Nitrate-Nitrogen Impact Analysis

Nitrogen, a naturally occurring element, is essential for the life processes of all living organisms. When nitrogen combines with oxygen, however, to form NO_3 or nitrate-nitrogen the result is a potential public health hazard when levels in groundwater exceed 10 milligrams per liter. Nitrate-nitrogen can be a cause of oxygen deficiency in babies (*Methemoglobinemia-Blue Bay Syndrome*) and may be the limiting nutrient that controls eutrophication (algal blooms) in coastal marine waters, estuaries, and some fresh water bodies. In addition, ammonia nitrogen is toxic to aquatic life. Less than 1 ppm is lethal to cold water fish, while 2-3 ppm is lethal to warm water fish.

Studies have shown that average nitrate-nitrogen levels of domestic effluent are approximately 40 milligrams per liter. Since that is four times the legally allowed levels for drinking water, it is important to assure that NO_3 concentrations are reduced to acceptable levels by the time they reach drinking water supplies and water bodies. In general, mandatory disposal area setbacks are adequate to allow for nitrate dilution to acceptable levels prior to reaching water wells or water bodies. Because of the potential for mounding, however, larger systems require an additional level of analysis to assure ground and/or surface water protection. Consultation with a Certified Geologist or engineer familiar with ground water hydrology is required for all engineered systems.

FLOOD PLAIN SITING:

New Systems may not be installed on 10 year flood plains; it is recommended that they not be installed in 100 year flood plains if possible.



Figure 71: *Septic tank under house, Camp Ellis, 1991*

The Site Evaluator is responsible for determining whether the site lies within a flood zone. Flood Insurance Studies are currently available for approximately 100 Inland and coastal communities in Maine. These studies contain a map of flood boundaries and flood profiles along water courses that indicate both the 10-year flood and 100-year flood elevations. (Figure 72)

Flood Insurance Studies contain a Map Index that can be used to reference the appropriate Floodway map. The site in question can be located on the Flood Boundary and Floodway Map (FBFM) and the closest transects to the site (flood profiles) can be referenced as well as closest bench marks. The 10-year and 100-year flood elevations for that site can then be extracted from the graph (Figure 73). This elevation uses National Geodetic Vertical Datum of 1929 (NGVD) as the reference.

The topographic elevation of the proposed disposal site can be referenced to the closest bench mark and then compared with the referenced flood elevations to determine, conclusively, if the site lies within a flood zone.

If Flood Insurance Studies have not been made for a community, other studies such as the Army Corp of Engineers, Soil Conservation Service or United States Geologic Survey should be sought. If no published studies are available, then local inhabitants of the area should be consulted.

For coastal flood plain delineation, see the following Section on Coastal Sand Dune.



Figure 72: Flood Boundary, Floodway Map

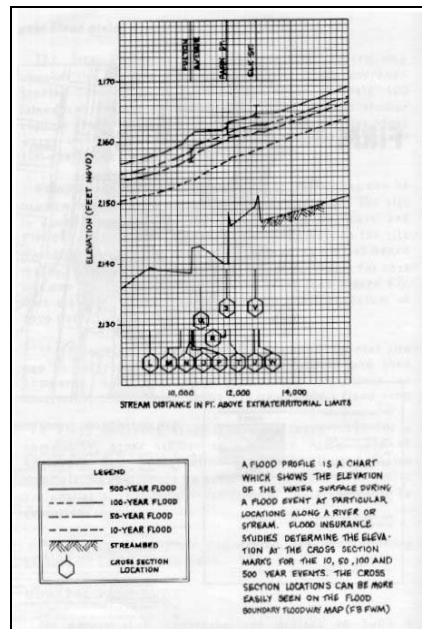


Figure 73: Flood Profile

COASTAL SAND DUNE

No person shall undertake any project to build a permanent structure or alter any coastal sand dune without obtaining a permit from either the Department of Environmental Protection or the Board of Environmental Protection. The Subsurface Wastewater Disposal Rules must be conformed to if the structure proposed on a coastal sand dune requires subsurface wastewater disposal.

Soil profiles of coastal sand dunes are classified as Profile II (See Table 8). These soils are sandy and generally exhibit very little soil horizonation development due to their lack of stability and geologic age. However, where these soils have been relatively stabilized to allow for vegetation of trees, they can exhibit some soil development. If the proposed site for the disposal area meets the requirements with regards to setback and drainage, then a special disposal system can be designed by the Site Evaluator. A special system is required to overcome the severe limitations of low cation exchange capacity, very high permeability, and proximity to waterbodies. The three special systems recognized by Health Engineering are:

- Sand or peat filter followed by a conventionally sized disposal area. The disposal area is usually sized at 2.6 square feet/gpd (medium hydraulic loading rate);
- Pressure distribution of wastewater in a conventionally sized disposal area;
- A medium-large size disposal area (3.3 square feet/gpd) with a minimum of 12 inches of sandy loam to loamy sand soil placed on the bottom and sides of the stone layer or chambers.

A proposed disposal area for a residential dwelling must comply with the required setback distances to the normal maximum high water line. This is the line on the shore which is apparent because of a change in character of the soil, rock, or vegetation resulting from submersion or the prolonged erosion action of the water. In a tidal environment, the normal maximum high water line is the shoreline at the average spring tide elevation as referenced in the Tide Tables (Annual) High and Low Water Predictions, published by the National Oceanic Survey.

For example, say a Site Evaluator was responsible for siting a disposal area on a relatively small parcel of coastal property on Goose Rocks Beach, Kennebunkport. The normal high water line was questionable based on field evidence of strand lines and vegetation. The Site Evaluator can refer to the Tide Tables (Annual), High and Low Water Predictions and find the closest point along the Maine coast referenced in the publication (See Table 11). For this example, Kennebunkport is the closest referenced point and the average spring tide elevation is 9.9 feet.

(See Table 11 Column “RANGES-Spring”). This elevation references Mean Low Water (MLW) as the datum. To convert MLW to NGVD, find the closest locality listed in Table 9 and subtract the corresponding number from MLW. The difference is the elevation expressed in NGVD. For this example, the closest locality list in Table 9 is “Cape Porpoise” with the difference between MLW and NGVD listed as “4.08”. Therefore: 9.90 ft. (MLW) – 4.08 (Conversion Factor) = 5.82 (NGVD). Once this elevation has been calculated, its actual location on the site can be established.

To determine the elevation on a particular site, it is necessary to begin with an established bench mark in the vicinity and transfer the grade to the site. The bench mark on the site can then be used to establish the contour line that represents 5.82 feet NGVD. Once this is determined the normal maximum high water line can be delineated and the setback distances can be accurately measured.

An easier, but less accurate method, would be to schedule a site investigation at high tide on a “normal” day. The Tide table, annual (Table 12) indicates that high tide at Kennebunkport, for example, occurs 16 minutes later and is 0.5 feet lower than the respective daily time and high water level published for Portland. For example, say May 16, 1983 is convenient for an on-site investigation. The Tide table, 1983 (Table 12) indicates that high tide at Portland will be at 1:40 P.M. and will be 9.1 feet MLW. Kennebunkport’s high tide occurs 16 minutes later and is 0.5 feet lower as referenced in Table 11 Tidal Differences. A Site Evaluator could schedule an on-site visit in Kennebunkport on May 16, 1983 at 1:56 P.M. (1:40 P.M. = 16 minutes) and be there at the expected arrival of high tide for that day. The high tide at Kennebunkport is expected to be 8.6 feet MLW $[9.1 \text{ ft. (High tide at Portland)} - 0.5 \text{ (Adjustment factor)} = 8.6 \text{ ft (High tide at Kennebunkport)}]$. These elevations referred to MLW and must be converted to NGVD with the use of Table 9 as previously explained, since Flood Boundary – Floodway maps reference NGVD elevations.

Table 11. Soil, Site & Engineering Factors Used in assessing Potential for a First Time System

SOILS

Soil Profile from Table 600.1	Points
Profiles 2, 3, & 7	15
Profiles 1, 8, & 9	10
Profile 4	7
Profiles 5, 6, & 11	5
Profile 10	Not permitted
AI bedrock class outside shoreland zone of major waterbodies/courses	Not permitted
AI & All bedrock classes within shoreland zone of major waterbodies/courses	Not permitted

SEASONAL GROUNDWATER OR RESTRICTIVE LAYER

Depth to seasonal groundwater or restrictive layer	Points
14 inches *	20
13 inches *	15
12 inches *	9
11 inches	6
10 inches	3
<10 to 7 inches	0
Less than 7 inches	Not permitted

* For sites within the shoreland zoned area of major waterbodies/courses

TERRAIN

Position in the landscape	Points
Knoll upland (no watershed)	5
Side slope	3
Lowland	minus 5
Depression	Not permitted

SIZE OF PROPERTY AND DISPOSAL AREA SETBACK FROM PROPERTY LINE

Total acreage	Points Setback <50'	Points Setback 50' - 99'	Points Setback 100' - 199'	Points Setback >200'
More than 10 acres	5	10	15	20
6 - 10 acres	4	7	11	15
5 - 6 acres	3	5	8	10
4 - 5 acres	2	4	6	8
3 - 4 acres	1	3	4	4
2 - 3 acres	1	2	3	3
1 - 2 acres	0	1	2	NA
½ - 1 acre	minus 10	NA	NA	
Less than 20,000 ft ²	Not permitted	Not permitted	Not permitted	

**Table 11. Soil, Site & Engineering Factors Used in assessing Potential for a First Time System
(Continued)**

MAJOR WATER BODY SETBACK

Setback distance from disposal area to major water bodies	Points
Greater than 250 feet	5
Between 150 - 250 feet	3
Between 100 - 149 feet	0
Less than 100 feet	Not permitted

WATER SUPPLY & ZONING

Type	Points
public water supply	5
private drilled well	3
other private supply	0
zoned for resource protection	Not permitted

TYPE OF DEVELOPMENT

Type	Points
Commercial less than 100 gpd	5
Commercial 100 - 300 gpd	3
Single-family residential	0
Commercial 301 - 750 gpd	minus 5
Commercial greater than 750 gpd	minus 10

DISPOSAL AREA ADJUSTMENT

Increase in minimum disposal area as determined from Chapter 5	Points
Minimum disposal area plus 66%	10
Minimum disposal area plus 33%	5
Minimum disposal area	0

ADDITIONAL TREATMENT

Type of treatment	Points
Curtain drains for Profiles 1, 3, 7 & 8	5
Liner (See Subsection 1601.0) for Profiles 5, 6 & 11 (if 11 is sandy)	3
Septic tank outlet filter	3

USE OF ADVANCED TREATMENT DEVICES OR SYSTEMS

Strength of effluent (BOD⁵ plus TSS)	Points
150 to 101 mg/l	5
100 to 51 mg/l	10
50 to 11 mg/l	15
10 mg/l or less	20

At 1:56 P.M., a stake could be driven at the shoreline on that day. The water level that day is expected to be approximately 8.6 ft. MLW or 4.52 ft. NGVD. The water level at that time can be used as a reference to establish the field contour at 5.82 NGVD (representing the normal maximum high water line) and the water level can also be used as a reference point to establish the approximate flood elevations on the site. *The actual shore line that day would be subject to the wind and offshore weather conditions which reduces the accuracy of this method.*

Site Evaluators must assure that the proposed area for the disposal system is not on or in the coastal and estuary flood plain. The coastal and estuary flood plain is defined by the Subsurface Wastewater Disposal Rules as the land area within the V-Zone indicated by Flood Insurance Rate Maps [FIRM] or below the 10-year storm surge elevation, whichever is more restrictive. A V-zone is land area of special flood hazard subject to a 1% or greater chance of flooding in any given year and is prone to additional hazard from high velocity water due to wave action. These areas are designated as Zones V, V1 – V30 on a community's Flood Insurance Rate Map. The Flood Zone and their respective elevations can be referenced from FIRM Maps.

Some site specific questions may require consultation with a coastal geologist.



Figure 74: *Sand dune soil profile*

Table 12. Mean low water to National geodetic vertical datum

Bench mark elevations above National Geodetic Vertical Datum may be obtained by subtracting the tabular difference from the published elevations above mean low water.

<u>Locality</u>	<u>NGVD-MLW</u>
	<u>Feet</u>
Eastport.....	9.00
Cutler, Little River.....	6.91
Machiasport.....	6.14
Shoppee Point, Englishman Bay.....	6.94
Jonesport, Sawyer Cove.....	5.75
Sand Cove, Gouldsboro Bay.....	5.07
Gouldsboro Bay (North End).....	5.10
Prospect Harbor.....	5.08
Winter Harbor, Frenchman Bay.....	4.97
Bar Harbor, Mt. Desert Island.....	5.16
Southwest Harbor (Clark Point), Mt. Desert Island.....	4.93
Bernard, Bass Harbor, Mt. Desert Island.....	4.79
Blue Hill Harbor, Blue Hill Bay.....	4.94
Belfast, Penobscot Bay.....	4.59
Rockland, Penobscot Bay.....	4.50
Port Clyde.....	4.38
Otis Cove, St. George River.....	4.38
Thomaston.....	4.53
Jameson point, (Davis Point) Friendship Harbor.....	4.43
Jones Neck, Medomak River.....	4.45
Waldoboro.....	4.62
Muscongus Harbor.....	4.39
Moxie Cove, Muscongus Sound.....	4.39

Table 12. Mean low water to National geodetic vertical datum (continued)

<u>Locality</u>	<u>NGVD-MLW</u>
	<u>Feet</u>
New Harbor, Muscongus Bay.....	4.28
Fort Point, Pemaquid Beach, Johns Bay.....	4.23
East Boothbay.....	4.28
East Edgecomb, Damariscotta River.....	4.41
Newcastle, Damariscotta River.....	4.46
Boothbay Harbor.....	4.28
South Port, Townsent Gut.....	4.24
Cross River (North End of Barter Island.....	4.30
Wiscasset, Sheepscot River.....	4.37
Sheepscot, Sheepscot River.....	4.67
Back River Ferry, Westport Island.....	4.24
Robinhood, Riggs Cove.....	4.12
Phipps Point, Hockomock Bay.....	4.10
Palace Cove (Mill Point), Sasanca River.....	3.94
Sasanoa River (Swett Point).....	2.70
(Upper Hell Gate).....	3.07
Hunniwell Pt. (Fort Popham), Kennebec River.....	3.83
Bath, Kennebec River.....	2.44
Brunswick, Androscoggin River.....	-0.05
Portland.....	4.28
Cape Porpoise (Bickford Island).....	4.08
York Harbor.....	3.98
Gerrish Island Wharf, Portsmouth Harbor.....	4.08
Kittery Point, Pepperell Cove, Portsmouth Harbor.....	4.08
Seavey Island (Portsmouth Naval Shipyard).	3.83

Table 13. Tidal Differences and Other Constants 1983

NO.	PLACE	POSITION Lat. Long.		DIFFERENCES					RANGES		Mean Tide Level
				Time		Height			Mean Spring		
						High Water	Low Water	High Water		Low Water	
		° ' N	° ' W	h. m.	h. m.	ft	ft	ft	ft	ft	
	Maine, Kennebec River Time meridian, 75°W			on PORTLAND, p.32							
833	Bath.....	43 55	69 49	+1 01	+1 17	-2.7	0.0	6.4	7.4	3.2	
835	Sturgeon Island, Merrymeeting Bay.....	43 59	69 50	+2 00	+2 04	*0.58	*0.58	5.3	6.1	2.6	
837	Androscoggin River entrance.....	43 57	69 53	+2 24	+3 26	*0.52	*0.52	4.7	5.4	2.3	
839	Brunswick, Androscoggin River.....	43 55	69 58	+2 35	+4 36	*0.42	*0.42	3.8	4.4	1.9	
841	Bowdoinham, Cathance River.....	44 00	69 54	+2 34	+2 42	*0.63	*0.63	5.7	6.6	2.8	
843	Richmond.....	44 05	69 48	+2 48	+3 03	*0.58	*0.58	5.3	6.0	2.6	
845	Nehumkeag Island.....	44 10	69 45	+3 21	+3 46	*0.58	*0.58	5.3	6.0	2.6	
847	Gardiner.....	44 14	69 46	+3 43	+4 25	*0.55	*0.55	5.0	5.7	2.5	
849	Hallowell.....	44 17	69 47	+3 54	+5 03	*0.47	*0.47	4.3	4.9	2.1	
851	Augusta.....	44 19	69 46	+4 03	+5 33	*0.45	*0.45	4.1	4.6	2.0	
	MAINE, Casco Bay										
853	Small Point Harbor.....	43 44	69 51	-0 12	-0 09	-0.3	0.0	8.8	10.1	4.4	
855	Cundy Harbor, New Meadows River.....	43 47	69 54	-0 01	-0 02	-0.2	0.0	8.9	10.2	4.4	
857	Howard Point, New Meadows River.....	43 53	69 53	-0 05	+0 01	-0.1	0.0	9.0	10.3	4.5	
859	Lowell Cove, Orrs Island.....	43 45	69 59	-0 07	-0 06	-0.3	0.0	8.8	10.1	4.4	
861	Harpwell Harbor.....	43 46	70 00	-0 05	-0 05	-0.1	0.0	9.0	10.4	4.5	
863	South Harpswell, Potts Harbor.....	43 44	70 01	+0 02	+0 01	-0.2	0.0	8.9	10.2	4.4	
865	Wilson Cove, Middle Bay.....	43 49	69 59	+0 02	+0 02	0.0	0.0	9.1	10.5	4.5	
867	Little Flying Point, Maquoit Bay.....	43 50	70 03	-0 01	-0 01	-0.1	0.0	9.0	10.3	4.5	
869	South Freeport.....	43 49	70 06	+0 12	+0 10	-0.1	0.0	9.0	10.3	4.5	
871	Chebeague Point, Great Chebeague Island.....	43 46	70 06	-0 04	-0 06	-0.1	0.0	9.0	10.4	4.5	
873	Prince Point.....	43 46	70 10	-0 02	-0 04	-0.1	0.0	9.0	10.4	4.5	
875	Peaks Island.....	43 39	70 12	-0 04	-0 08	-0.1	0.0	9.0	10.4	4.5	
877	PORTLAND.....	43 40	70 15	Daily predictions							4.6
	MAINE, Outer Coast-Continued										
879	Richmond Island.....	43 33	70 14	-0 03	0 00	-0.2	0.0	8.9	10.1	4.4	
881	Old Orchard Beach.....	43 31	70 22	0 00	-0 03	-0.3	0.0	8.8	10.1	4.4	
883	Wood Island Harbor.....	43 27	70 21	+0 02	-0 04	-0.4	0.0	8.7	9.9	4.3	
885	Cape Porpoise.....	43 22	70 26	+0 12	+0 17	-0.4	0.0	8.7	9.9	4.3	
887	Kennebunkport.....	43 21	70 28	+0 16	+0 16	-0.5	0.0	8.6	9.9	4.3	
889	York Harbor.....	43 08	70 38	+0 03	+0 13	-0.5	0.0	8.6	9.9	4.3	

TABLE 14. TIME AND HEIGHTS OF HIGH AND LOW WATERS PORTLAND, MAINE 1983

High and Low Waters Portland, Maine, 1983							
MAY							
Time Height				Time Height			
Day	h m	ft	m	Day	h m	ft	m
1	0132	9.4	2.9	16	0058	10.5	3.2
Su	0756	-0.4	-0.1	M	0727	-1.3	-0.4
	1409	8.3	2.5		1340	9.1	2.8
	2004	0.9	0.3		1939	0.2	0.1
2	0217	9.0	2.7	17	0150	10.4	3.2
M	0841	0.1	0.0	Tu	0822	-1.1	-0.3
	1457	7.9	2.4		1437	8.9	2.7
	2051	1.3	0.4		2035	0.5	0.2
3	0305	8.7	2.7	18	0249	10.1	3.1
Tu	0931	0.6	0.2	W	0921	-0.7	-0.2
	1547	7.7	2.3		1538	8.8	2.7
	2142	1.7	0.5		2139	0.7	0.2
4	0355	8.4	2.6	19	0352	9.8	3.0
W	1024	1.0	0.3	Th	1024	-0.4	-0.1
	1641	7.5	2.3		1645	8.9	2.7
	2237	2.0	0.6		2246	0.8	0.2
5	0451	8.2	2.5	20	0501	9.5	2.9
Th	1119	1.2	0.4	F	1128	-0.2	-0.1
	1738	7.6	2.3		1751	9.0	2.7
	2334	2.0	0.6		2357	0.7	0.2
6	0549	8.1	2.5	21	0611	9.4	2.9
F	1211	1.3	0.4	Sa	1232	-0.1	0.0
	1832	7.8	2.4		1854	9.3	2.8
7	0032	1.8	0.5	22	0106	0.4	0.1
Sa	0644	8.2	2.5	Su	0719	9.3	2.8
	1301	1.2	0.4		1333	-0.1	0.0
	1920	8.1	2.5		1954	9.7	3.0
8	0123	1.5	0.5	23	0207	0.0	0.0
Su	0736	8.3	2.5	M	0821	9.3	2.8
	1349	1.0	0.3		1427	-0.2	-0.1
	2002	8.4	2.6		2047	10.0	3.0
9	0212	1.0	0.3	24	0303	-0.5	-0.2
M	0821	8.5	2.6	Tu	0916	9.3	2.8
	1431	0.7	0.2		1519	-0.2	-0.1
	2044	8.9	2.7		2135	10.1	3.1
10	0255	0.4	0.1	25	0353	-0.8	-0.2
Tu	0907	8.7	2.7	W	1007	9.2	2.8
	1511	0.4	0.1		1606	-0.1	0.0
	2121	9.3	2.8		2221	10.1	3.1
11	0339	-0.2	-0.1	26	0441	-1.0	-0.3
W	0948	8.9	2.7	Th	1054	9.0	2.7
	1551	0.1	0.0		1649	0.0	0.0
	2202	9.7	3.0		2303	10.1	3.1
12	0421	-0.7	-0.2	27	0526	-1.0	-0.3
Th	1030	9.0	2.7	F	1139	8.9	2.7
	1630	-0.1	0.0		1731	0.2	0.1
	2240	10.1	3.1		2345	9.9	3.0
13	0503	-1.2	-0.4	28	0608	-0.8	-0.2
F	1114	9.1	2.8	Sa	1222	8.6	2.6
	1713	-0.2	-0.1		1812	0.5	0.2
	2325	10.4	3.2				
14	0549	-1.4	-0.4	29	0026	9.6	2.9
Sa	1159	9.2	2.8	Su	0649	-0.5	-0.2
	1758	-0.2	-0.1		1303	8.4	2.6
					1854	0.8	0.2
15	0009	10.5	3.2	30	0105	9.4	2.9
Su	0636	-1.5	-0.5	M	0731	-0.2	-0.1
	1247	9.2	2.8		1345	8.2	2.5
	1846	-0.1	0.0		1935	1.1	0.3

INSPECTION REPORTS

Site Evaluators, because of their expertise in subsurface wastewater disposal, are sometimes requested to evaluate the condition or potential of an existing disposal system. The request may be from loan institutions or prospective buyers prior to the sale of properties with an on-site subsurface wastewater disposal system, or from owners who desire to expand their businesses or dwellings and need to determine the adequacy of the facility.

The first step in conducting a septic system inspection is to gather as much information as possible from the system owners. Questions of the system owner or user should include:

- ❑ What type of disposal system exists: (cesspool, trench, bed, dry well or other)?
- ❑ How deep was it installed?

If the system was legally installed after 1974, there is a high probability that a copy of the application for the permit is available either at the Municipal Town Hall or with the Division of Health Engineering. The copy of the application would be a record of the original soil conditions reported, size and location of disposal system components, and design flow data. The theoretical potential for the system could then be calculated based upon current design specifications. An objective statement on the ability of the system could then be made based upon field assessment and theoretical design capacity.

Records of systems installed prior to 1974 are generally incomplete. The Division of Health Engineering does not have this information; neither do most municipalities. For the most part, systems constructed prior to 1974 would not meet current standards. The value of information gained by excavating into an old system is limited and offers a risk of damage. Determining what size components exist is of some use however; an elevation of what it would take to replace the existing system with its proposed increased wastewater flow is often of more value than attempting to determine the flow capacity of an old existing disposal area constructed prior to 1974.

After gathering as much information as possible from the owners, the next step would be to conduct the physical inspection of the system.

The actual inspection steps will depend upon the type of disposal system, soil, and what information is available on the system's design. The following are suggested as minimum steps in an inspection program:

- ❑ If a subsurface wastewater disposal system form (HHE-200) is available, use it to determine if the disposal system was installed as designed.
- ❑ Locate the septic tank (if one exists) then inspect the inlet and outlet baffles. Are they in good working order? What is the solids and grease accumulation level? Has scum passed through the outlet baffle opening? Are the baffles present, in good working order, or show evidence of solids passing through the opening? If the septic tank has too great a

solid load, it is safe to assume solids have entered the disposal area and reduced its infiltrative capacity. Look for signs of groundwater infiltration or ex-filtration.

- ☐ If the distribution box is present, locate the cover, remove it and inspect for liquid level and solids accumulation.

Solids can also be checked for in the pipes out-letting to the disposal area. If solids are observed in the distribution box or outlet pipes, it is safe to assume that some solids have entered the disposal area and reduced its infiltrative capacity. The liquid level in the distribution box will tell much about the function of the disposal area. A properly functioning disposal area should not have a liquid level greater than a depth of 25% of the outlet pipes.

- ☐ If a pump station is used, the cover should be pulled and the tank should be inspected for solids carryover from the septic tank. Solids in the pump chamber, side walls and on the pump itself is evidence that solids have more than likely been pumped to the disposal area.
- ☐ Locate the disposal area, if possible. Check for lush vegetation in spots over the surface, soft places or obvious areas where effluent has surfaced.
- ☐ Site Evaluators can excavate a test pit beside the disposal area to determine limiting factor depth. If the limiting factor depth is shallow but the disposal system is completely below original grade, then the system is installed too deep to function properly.
- ☐ A test pit will also provide information as to soil type, so that a reasonable estimate of disposal system size can be determined. Compare existing disposal system size to the recommended size.
- ☐ If little information is available about the disposal area and a water body or water course is nearby, a dye test might be appropriate to look for direct discharges.
- ☐ Running water (with dye) for an extended period of time is helpful in detecting a system failure but an inspection of the septic tank should first take place. A wise system owner, particularly if the system is functioning marginally, might pump the tank the day before an inspection. That would mean 1000 gallons of water would have to run before any would reach the disposal area.
- ☐ If no distribution box is present, dig a test pit into the disposal system to determine effluent levels. Also, look for biologic mat evidence above current liquid levels for an indication of periodic stress. Look for thickness of biologic mat within the stone or beneath chambers (if used).
- ☐ If the system is installed in shallow soils, particularly near water bodies, look for evidence of effluent and/or a biologic mat. If no effluent or biologic mat exists, a short circuit may exist where effluent is draining through bedrock seams. Short circuiting can

also occur in very coarse textured soils and may be a problem in shoreland zoned areas, or where bedrock is located at relatively shallow depths below the ground surface.

The report which is issued to the home owner or prospective buyer, after conducting a septic system evaluation, must be conditioned by how much hard data was available or gathered as compared to how much was assumed. If, however, a thorough investigation was conducted, then a reasonable expectation can be offered as to the proper function of a disposal system.

REGULATIONS

Multi-user (Cluster) Systems

Under ideal circumstances, each individual building, under one ownership, should have its own disposal system. There are occasions, however, when that is not practical or possible and several structures must share a disposal system or parts of a system. When three or more structures, under different ownership, are proposed to be served by a single disposal system or disposal area, ownership of all parts of the system, beyond the building sewer, must be vested in an independent, legally established entity under Maine Law. This is primarily because of many unique problems associated with shared systems, including determination of responsible parties for maintenance, repairs and other costs.

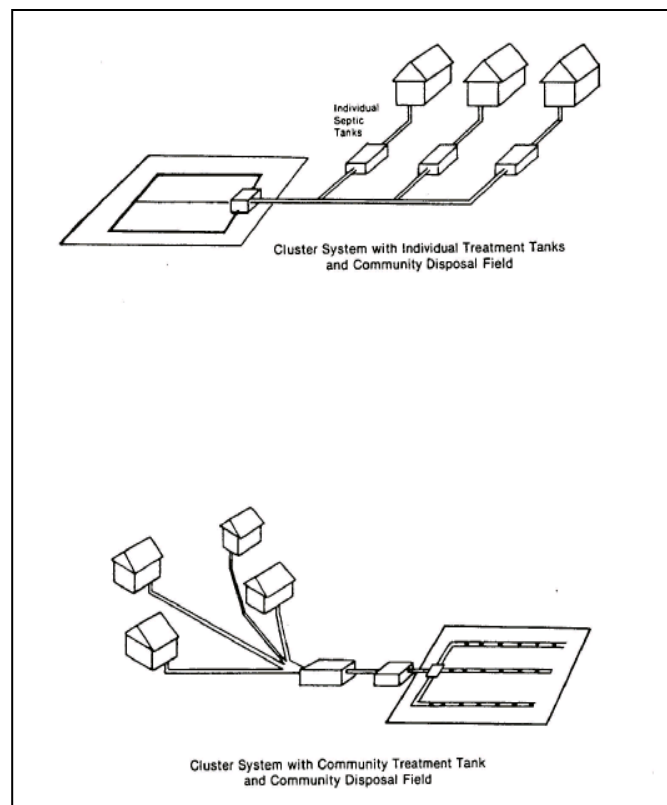


Figure 75. *Cluster Systems*

A cluster system may have a private sewer collection system flowing into a large septic tank to treat the total flow or it may have building drains flowing into individual smaller septic tanks. The wastewater, after receiving primary treatment in the septic tank or tanks may be pumped or gravity fed to a single subsurface disposal area or several fields on a common land area. (see Figure 75)

The cluster system is a relatively new concept in Maine that is being proposed more frequently; because the design can accommodate development interests on properties with site and soil limitations. However, cluster system proposals have been meeting with local opposition in many communities, perhaps due to increased complexity and unique problems associated with shared systems.

The engineering and technical designs of cluster systems are well established. Generally, a cluster system is proposed for developing a parcel of land when a segment of land area within that parcel is better suited for subsurface disposal than the remaining portion. Often times, shallow to bedrock or seasonal high groundwater table conditions prevail on the more poorly suited land area. Therefore, the design of the sewer collection system should address either potential groundwater infiltration, freeze up, or both. Septic tank, pumps, disposal area, and other components must be designed and sized to properly treat and dispose of the wastewater.

A proposed cluster disposal system, that is not intended to be installed all at once, may present practical construction problems in the future. Any proposed modular approach to cluster system construction should address practical concerns such as: when the system will be installed, how the system will be expanded, how and where the wastewater will be redirected during construction, and how the area will be dried out prior to construction.

MALFUNCTIONING SYSTEMS, TROUBLE SHOOTING AND REMEDIES

The various versions of the *Subsurface Wastewater Disposal Rules* have and continue to employ the best available technology regarding the design and installation of disposal systems. Unfortunately, that does not prevent those systems from occasionally malfunctioning prematurely. It is therefore necessary for Local Plumbing Inspectors and Site Evaluators to be able to determine when and why a disposal system is failing.

There are three common failures typically associated with disposal systems:

- A back-up of effluent into the building
- Surfacing of effluent on the ground, causing a public nuisance or health hazard
- Effluent that is not properly treated by soil prior to discharge into ground and/or surface waters.

Failures can be caused by a number of factors, including:

- Blockage of plumbing

- Improper disposal system design
- Improper disposal system installation
- Improper disposal system use
- Defective disposal system components

Sometimes, a disposal area that is not functioning properly can be corrected without replacing the entire system. The age of the system, quality of construction, size and integrity of system components, wastewater generation, usage, soil conditions, and site conditions, potential for public sewer extension, economic factors, and risk acceptability must all be considered. Generally, the Division of Health Engineering does not recommend rejuvenating attempts to a system that was constructed prior to 1974.

Systems that were designed and properly installed after 1974 usually are more worthy of rejuvenation attempts than older systems. Systems that have been determined to have good chances of rejuvenation usually receive either: mechanical excavation of the sealed sidewall and disposal area expansion, or addition to fill extensions.

Mechanical excavation of a sealed sidewall and expansion of the disposal area is a procedure that is used most frequently on systems that have failed, due to the development of an impermeable organic mat at the interface of the disposal area and surrounding soil. Mechanical removal of the impermeable sidewalls and expansion of the disposal area has succeeded in correcting malfunctions when properly prescribed.

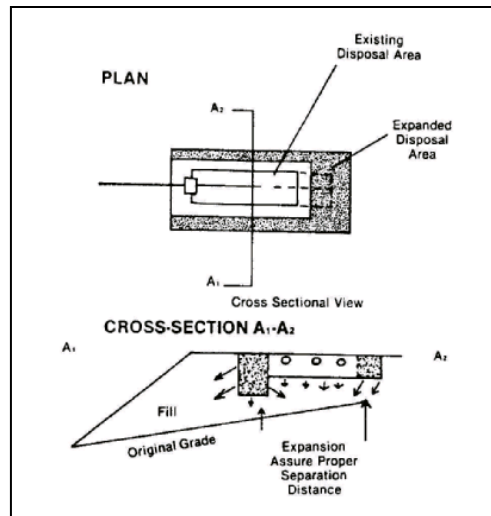


Figure 76. *Disposal area expansion and sidewall excavation*

Adding fill material or extending fill extensions will not permanently correct a disposal area that has failed due to physical, chemical or biological clogging. However, adding or extending fill may be a valid solution for a disposal area that has been constructed above the original soil surface and is failing due to seepage breakout through the fill material or where the 3 foot shoulders were not fully installed. Hydraulic mounding may occur on modified sites, where the underlying original soils have relatively low infiltration capacities and slow permeabilities, where compaction or smearing have occurred, fill extensions in the direction of the hydraulic gradient are minimal, and hydraulic loadings are moderate to high. Wastewater in this situation readily permeates into the surrounding fill throughout the entire sidewall and bottom area of the disposal bed, but surfaces in, or at the edge of, the surrounding fill. Short circuiting may occur when a system was constructed with improper fill extensions or shoulders and when wastewater seeps through an area of least resistance to flow. The disposal area will not hold an excessive amount of wastewater when hydraulic mounding and short circuiting occur. If the disposal area is full of wastewater, filling the area should not be considered as a permanent solution.

Permits are not required for adding fill material or extending fill extensions, however, it is advisable that the Local Plumbing Inspector be notified of the activity.

HYDROGEN PEROXIDE TREATMENT

In the past, the application of hydrogen peroxide was occasionally recommended to rejuvenate failed fields. Hydrogen peroxide is a strong oxidizing agent and was thought to be an effective method to eliminate excessive organic mat build-up. Experience has shown, however, that the strong effervescent action of the peroxide destroys soil structure in the underlying soils, thereby preventing effluent from using the normal pathways it takes to move through the soil. In addition, the underlying reason for initial failure may not be addressed, such as undersizing, too deep installation, smearing, compaction, etc. Therefore, hydrogen peroxide is now rarely used, and only when the soil is a coarse, single grain structure and failure is due to misuse that can be corrected by educating the system user.

GLOSSARY

Aerobic: A condition in which molecular oxygen is part of the environment.

Aggregate: Many soil particles held in a single mass or cluster such as a clod, crumb, block or prism.

Alternative toilet: A device, other than a water closet, designed to treat human waste only. Examples are: privies and compost, chemical, recirculation, incinerating, and vacuum toilets.

Anaerobic: A condition in which molecular oxygen is absent from the environment.

Backfill: Soil material that is suitable for use beneath and beside the disposal field, including fill extension.

Bedrock: A solid and continuous body of rock, with or without fractures, or a weathered or broken body of rock fragments overlying a solid body of rock.

Black wastewater: Wastewater derived from plumbing fixtures or drains that receive excreta supplemented wastewater.

Building Sewer: That part of the plumbing system that extends from the end of the building drain and conveys its discharge to a public sewer, septic tank and disposal field, or other point of disposal.

Capillary: The attraction of water molecules to soil particles in small soil pore openings of the approximate diameter of a hair (*Latin for "hair" is capilla*).

Cation exchange: The interchange between a cation (positively charged ion)

in solution and another cation on the surface of any surface active material such as clay or organic matter.

Certificate of approval: A certificate signed by the plumbing inspector stating that a system has been installed in compliance with the disposal system permit application and the *State of Maine Subsurface Wastewater Disposal Rules*.

Cesspool: A covered excavation that receives wastewater or other organic wastes from a structure, and is designed to retain the organic matter and solids, but allows liquids to seep through the bottom and sidewalls.

Chroma: The relative purity or strength of color of soil; a quality that decreases with increasing grayness. Chroma is one of the three variables of color as defined in the Munsell system of color classification.

Clay: A particle size category consisting of mineral particles that are smaller than 0.002 millimeter in equivalent spherical diameter; also, a soil texture class having more than 40% clay, less than 45% sand, and less than 40% silt.

Clay Loam: A soil texture class having 27 to 40% clay and 20 to 45% sand.

Coastal sand dune: Sand deposit within a marine beach system above high tide including, but not limited to: beach berm, frontal dune ridge, back dune area, and other sand areas deposited by wave or wind action.

Cobble: A rock fragment that is rounded or semi-rounded in shape and is between 3 and 10 inches in diameter.

Curtain drain: A trench to intercept laterally moving ground water and divert it away from a disposal area.

Design Flow: The wastewater flow that may reasonably be expected to be discharged from a facility on any day of operation.

Disposal area: Individual subsurface wastewater disposal system components, consisting of a closed excavation made within soil or fill material to contain disposal field stone, or approved proprietary devices.

Distribution box: A water-tight structure that receives septic tank effluent and distributes such effluent in equal portions to two or more disposal areas or distribution pipes with a disposal area.

Distribution pipe: A perforated pipe or one of several perforated pipes used to carry and distribute septic tank effluent throughout the disposal area.

Diversion ditch: A ditch to intercept and divert surface water runoff.

Drainage ditch: A manmade ditch receiving and diverting surface runoff or subsurface water. This does not include diversion of a naturally occurring water body.

Elevation Reference Point: An easily-identifiable point or object of constant elevation for establishing the relative elevation of observation holes and elevation of the components of the system.

Eluviation: The removal of soil materials in suspension from a soil leached horizon.

Fill material: Any soil, rock or other material placed within an excavation or over the surface of the ground. The term is equivalent in meaning.

Floodplain, coastal and estuary: The land area within the V-Zone indicated by the Federal Insurance Rate Maps (FIRM) or below the 10-year storm surge elevation, whichever is more restrictive. The 10-year storm surge elevation in Maine is approximately the 8-foot National Geodetic Vertical Datum.

Floodplain, riverine: The land area within the 10-year flood zone indicated by Soil Conservation Soil Service Maps or other sources acceptable to the Department in the absence of Soil Conservation Service Maps. Note: Some municipalities restrict new development in the 100-year flood plain.

Gpd: Gallons per day.

Gleization: A process whereby the soil undergoes intense reduction caused by the soil being saturated and having the following conditions: being free of dissolved oxygen, having soil temperatures above biologic zero (41°F), and having the presence of food for microorganisms (organic matter).

Gleyed: A condition found in mineral soils (or mineral soil elements) resulting from intense reduction, generally with matrix colors of chroma 2 or less in loamy textured soils and chroma 3 or less in sandy soils. Mottles may or may not be present. This condition is characterized by low chroma colors including black, green, and various shades of gray and darker shades of brown or red.

Gravel: A rounded or semi-rounded rock fragment that is between 2 millimeters and 3 inches in diameter.

Gravitational pressure: The force of gravity acting on soil water that tends to pull the water downward.

Gray wastewater: That portion of the wastewater generated within a residential, commercial, or institutional facility that does not include discharges from water closets and urinals.

Grease interceptor: A device in which the grease in wastewater leaving a structure is intercepted, congealed by cooling, accumulated, and stored for pump-out and disposal.

Grease trap: A device designed to retain grease from a single plumbing fixture.

Groundwater: Water below the land surface in a zone of soil saturation.

Groundwater aquifer: A rock or gravel formation that contains significant recoverable quantities of water that is likely to provide drinking water supplies.

Groundwater mounding: The rise in the groundwater table directly beneath a disposal system, due to the increase in liquid (i.e. wastewater) to the area.

Groundwater table: The upper surface of a zone of saturation.

H-20 wheel load: A wheel loading configuration as defined by the American Association of State Highway Officials for a standardized 1-ton-per-axel truck.

Hazardous waste: Any chemical substance or material, whether gas, solid or liquid, that is designated as hazardous

by the U.S. Environmental Protection Agency pursuant to the United States Resource Recovery and Conservation Act, Public Law 94-580.

Holding tank: A closed, water-tight structure designed and used to receive and store wastewater or septic tank effluent. A holding tank does not discharge wastewater or septic tank effluent to surface or ground water or onto the surface of the ground. Holding tanks are designed and constructed to facilitate ultimate disposal of wastewater at another site.

Horizon, A: The mineral soil horizon that lies at or near the surface. These contain a strong admixture of humified organic matter that tends to impart a darker color than that of the lower soil horizons.

Horizon, Ap: The mineral soil horizon characterized by the mixing of O, A and B horizons, caused by the action of plows, etc.

Horizon, B: The mineral soil horizon characterized by the maximum accumulation of materials such as iron and aluminum oxides and silicate clays.

Horizon, C: The mineral soil horizon that is little affected by the weathering process and lacks properties of O, A, E and B horizons. The C horizon may be either like or unlike the parent materials from which the upper soil horizons were formed. It is outside the zones of major biological activities and is little affected by soil-forming processes.

Horizon, E: The mineral soil horizon in which the main feature is loss of silicate clay, iron, aluminum, or a combination of these, leaving a concentration of sand and

silt particles and exhibiting obliteration of all or much of the original rock structure. It is usually lighter in color than the underlying B horizon and is usually found between A and B horizons, or O and B horizons.

Horizon, O: The organic soil horizon characterized by un-decomposed or partially decomposed litter (such as leaves, pine needles, twigs, moss, and lichens) that has been deposited on the surface of the ground.

Horizon, hydraulically restrictive: A soil horizon, or zone within a soil profile, that slows or prevents the downward or lateral movement of water.

Horizon, limiting: Any soil horizon or combination of soil horizons, within the soil profile or any parent material below the soil profile, that limits the ability of the soil to provide treatment or disposal of septic tank effluent. Limiting horizons include bedrock, hydraulically restrictive soil horizons and parent material, excessively coarse soil horizons and parent material, and seasonal ground water table.

Horizon, soil: A layer within a soil profile differing from the soil above or below it in one or more soil morphological characteristics. The characteristics of the layer include the color, texture, rock-fragment content, structure and consistence of each parent soil material.

Hue: The dominant spectral color, one of the three variables of soil color defined within the Munsell system of color classification.

Hydric soil: A soil that in its undrained condition is saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation.

Hydrology: The science dealing with the properties, distribution, and circulation of water.

Hydrostatic pressure: The pressure exerted by the gravitational weight of a column of water (see gravitational pressure).

Illuviation: The build-up or accumulation of soil material usually carried from an overlying horizon.

Intermittent watercourse: A stream, brook or wetland area that flows less than 6 months of the year.

Invert: The floor, bottom or lowest portion of the internal cross section of a closed conduit, used with reference to pipes or fittings conveying wastewater or septic tank effluent.

Lacustrine deposits: Deposits laid down in lake bodies. Lacustrine deposits are usually slightly coarser than marine sediments and may exhibit lenses of fine sand and sandy loam material in lower portions of the soil profile.

Lined disposal field: A filtration layer of backfill placed directly beneath and adjacent to a disposal field.

Malfunctioning system: A system that is not operating or is not functioning properly. Indications of a malfunctioning system include, but are not limited to, any of the following: ponding or outbreak of

wastewater or septic tank effluent onto the surface of the ground; seepage of wastewater or septic tank effluent into parts of buildings below ground; back-up of wastewater into the building served that is not caused by a physical blockage of the internal plumbing; or contamination of nearby water wells or surface water bodies.

Marine deposits: Fine sediments deposited on the ocean floor. These deposits are usually silt loam, silty clay loam, or silty clay. These deposits usually become firm and dense with increasing soil depth.

Matrix color: The predominant color of the soil in a particular horizon.

Mineral soil: Any soil consisting primarily of sand, silt and clay, rather than organic matter. In general, the organic carbon content is less than 20% by weight.

Mottles, drainage: Soil color patterns caused by alternating saturated and unsaturated soil conditions. When saturation occurs while soil temperatures are above biological zero (41°F), iron and manganese will become reduced and exhibit subdued shades such as grays, greens, or blues. When unsaturated conditions occur, oxygen combines with iron and manganese to develop brighter soil colors such as yellow and reddish brown. Soils that experience seasonally fluctuation water tables usually exhibit alternating streaks, spots or blotches of bright oxidized colors with reduced dull or subdued colors. The longer a soil is saturated and in an anaerobic condition, the greater is the percentage of color that will be subdued. Soils that are never or

rarely exposed to free oxygen are considered totally reduced or gleyed.

Mottling: A color pattern observed in soil consisting of blotches or spots of contrasting color. The term “mottle” refers to an individual blotch or spot.

Munsell system: A system of classifying soil color consisting of an alpha-numeric designation for hue, value, and chroma, such as “7.5YR6/2”, together with a descriptive color name, such as “strong brown”.

Normal high water line-riverine, stream, lake and pond: That line on the shore or bank that is apparent from visible markings, changes in the character of soil, rock or vegetation resulting from submersion or the prolonged erosion action of the water.

Observation hole: An observation hole dug by hand, backhoe or auger, or a soil core taken intact and undisturbed using a probe.

Orstein: A soil layer in the **B** horizon of coarse textured soils that is cemented with iron or organic matter.

Parent materials: The unconsolidated and more or less unweathered mineral or organic matter from which the soil profile is developed.

Perched seasonal ground water table: A seasonal ground water table that occurs immediately above a hydraulically restrictive soil horizon.

Percolation: The downward movement of water through the soil.

Perennial watercourse: A stream or brook that flows greater than 6 months of the year.

Permeability: The rate at which water moves through a unit of soil or rock material.

Pit privy: An alternative toilet placed over an excavation where human waste is deposited.

Pore (soil): Space between soil grains.

Pressure distribution: A method of directing wastewater to a disposal area by means of a pump to assure even flow throughout the area.

Primitive disposal area: A minimal disposal area designed specifically to treat gray wastewater originating from a non-pressurized water supply.

Proprietary disposal device: A device utilized in disposal areas as an alternative to a disposal area with a bedding of stone and one or more distribution pipes.

Redoximorphic features (Drainage Mottles): Redoximorphic features associated with wetness result from the reduction and oxidation of iron and manganese compounds in soil after saturation with water and de-saturation, respectively. The reduced iron and manganese ions are mobile and may be transported by water as it moves through the soil. Certain redox patterns occur as a function of the patterns in which the ion-carrying water moves through the soil, and of the location of aerated zones on the soil. Redox patterns are also affected by the fact that manganese is reduced more rapidly upon aeration. Characteristic color patterns are created by these

processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in the soil. Wherever the iron and manganese is oxidized and precipitated, it forms either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redox process in a soil may result in redoximorphic features that are defined as follows:

Redox concentrations: These are zones of apparent accumulation of Fe-Mn oxides, including:

- (1) Nodules and concretions, i.e. firm, irregularly shaped bodies with diffuse boundaries if formed *in situ* or with sharp boundaries in weathered soil horizons;
- (2) Masses, i.e. soft bodies of variable shapes within the matrix; and
- (3) Pore linings, i.e. zones of accumulation along pores which may be either coatings on the pore surfaces or impregnations from the matrix adjacent to the pores.

Redox depletions: These are zones of low chroma (2 or less) where either Fe-Mn oxides alone or both Fe-Mn oxides and clay have been stripped out, including:

- (1) Iron depletions, i.e. zones which contain low amounts of Fe and Mn oxides but have clay content similar to that of the adjacent soil matrix.

- (2) Clay depletions, i.e. zones which contain low amounts of Fe, Mn and clay.

Refusal: Depth of excavation limited by the inability to dig deeper with implement being used which is usually caused by encountering bedrock or firm basal till.

Rock fragment: A fragment of rock, contained within the soil, that is greater than 2 millimeters in equivalent spherical diameter or that is retained on a 2-millimeter sieve.

Sand: A particle size category consisting of mineral particles that are between 0.05 and 2 millimeters in equivalent spherical diameter. Also a soil textural class having 85% or more sand along with a maximum of 15% silt and clay. The percentage of silt may not be more than 1.5 times the percentage of clay.

Saturated: A condition in which all easily drained voids between the soil particles are temporarily or permanently filled with water.

Scum: A mass of wastewater solids floating on the surface of the wastewater and buoyed up by entrained gas, grease, or other substances.

Seasonal conversion permit: Written authorization issued by the plumbing inspector to allow the conversion of a seasonal dwelling unit located in a shoreland zone to year-round use.

Seasonal ground water table: The upper limit of seasonal ground water. This zone may be determined by identification of soil drainage mottling or by monitoring, or **MAPSS** drainage key.

Septage: All sludge, scum, liquid or any other material removed from a septic tank or disposal area.

Septic tank: A water-tight receptacle that receives the discharge of untreated wastewater. It is designed and installed so as to permit settling of settleable solids from liquid, retention of the scum, partial digestion of the organic matter and discharge of the liquid portion into a disposal area.

Septic tank effluent: Primary treated wastewater discharged through the outlet of a septic tank and/or an approved sand, peat or similar filter.

Septic tank filter: A device designed to keep solids and grease in the septic tank.

Serial distribution: A method of distributing septic tank effluent between or within a series of disposal areas so that each successive disposal area receives septic tank effluent only after the preceding disposal areas have become full to the bottom of the invert.

Setback distance: The shortest horizontal distance between a component of a system and certain site features or structures.

Shoreland zone area: All land area within 250 feet, horizontal distance, or the normal high-water line of any great pond, river or salt water body; or within 250 feet, horizontal distance, of the upland edge of a freshwater or coastal wetland; excluding any forested wetland; or within 75 feet, horizontal distance, of the normal high-water line of a stream.

Silt: A particle size category consisting of mineral particles that are between 0.002

and 0.05 millimeters in equivalent spherical diameter. It also means a soil textural class having 80% or more of silt and 12% or less of clay.

Silt loam: A soil textural class having 50% or more of silt and 12 to 27% clay; or 50 to 80% of silt and less than 12% clay.

Site evaluation: The practice of investigating, evaluating and reporting the basic soil and site conditions that applies to wastewater treatment and disposal along with a system design in compliance with the *State of Maine Subsurface Wastewater Disposal Rules*.

Site Evaluator: A person licensed to practice Site Evaluation in Maine.

Sludge: A relatively dense accumulation of wastewater solids that settle to the bottom of a septic tank. These solids are relatively resistant to biological decomposition and collect in the septic tank over a period of time.

Soil aggregate: A naturally occurring unit of soil structure consisting of particles of sand, silt and clay, organic matter and rock fragments held together by the natural cohesion of the soil.

Soil color: The soil color, particularly as determined by comparison of the moist soil with color chips contained in a Munsell soil color book.

Soil consistence: The resistance of a soil horizon to deformation.

Soil horizon: See definition, "Horizon, soil".

Soil material: Soil as well as any naturally occurring unconsolidated mineral deposit that is not bedrock.

Soil profile: A vertical cross section of the undisturbed soil showing the characteristic soil horizontal layers or soil horizons that have formed as a result of the combined effects of parent material, topography, climate, biological activity and time.

Soil saturation: The state when all the pores in the soil are filled with water. Water will flow from saturated soils into an observation hole.

Soil structure: The naturally occurring arrangement, within a soil horizon, of sand, silt and clay particles, rock fragments and organic matter that are held together in clusters or soil aggregates.

Soil texture: The relative proportions of sand, silt and clay in soil.

Stone: A rock fragment that is rounded or semi-rounded in shape and greater than 10 inches in diameter.

Stratified drift deposits: Deposits laid down by glacial melt water streams from the last glacier. All stratified drift deposits exhibit some degree of alternating layers of different but well-sorted particles.

Stream: A free-flowing body of water from the outlet of a great pond or the confluence of two perennial streams (as depicted on the most recent edition of a United States Geological Survey 7.5 minute topographical map or, if not available, a 15 minute topographical map) to the point where the body of water becomes a river.

Subsurface wastewater disposal

system: Any system designed to dispose of waste or wastewater on or beneath the surface of the earth; includes, but is not limited to: septic tanks, disposal areas, and grandfathered cesspools, holding tanks, pre-treatment filter, piping or any other fixture, mechanism or apparatus used or those purposes.

System: See definition, “Subsurface wastewater disposal system.”

Till: Deposits of glacial material laid down in place. These deposits are neither sorted nor stratified and consist of a heterogeneous mixture of silt, sand, gravel, cobbles and stones.

Till, ablation: Till deposited by the settling of soil particles and rock fragments from the melting glacial ice. It is loose, sandy and easy to excavate.

Till, basal: Till laid down at the bottom of the glacier. It is fine-grained, compact and difficult to excavate.

Variance: Written authorization that permits some act or condition not otherwise permitted by the *State of Maine Subsurface Wastewater Disposal Rules*.

Value: The relative lightness or intensity of a color, one of the three variables of soil color defined within the Munsell system of classification.

Vault privy: An alternative toilet that retains human waste in a sealed vault.

Wastewater: Any liquid waste containing animal or vegetable matter in suspension or solution, or the water-carried wastes from the discharge of water closets, laundry tubs, washing

machines, sinks, dishwashers or other source of water-carried wastes of human origin. This term specifically excludes industrial, hazardous or toxic wastes and materials.

Water course: A channel created by the action of surface water and characterized by the lack of upland vegetation or the presence of aquatic vegetation and by the presence of a bed devoid of top soil containing waterborne deposits on exposed soil, parent material or bedrock.

Water well: A bored, drilled or driven shaft or a dug hole that extends below the seasonal ground water table and is used as the primary drinking water supply.

Wetland: Area that has a predominance of hydric soils and that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions.

Wetland, coastal: All tidal and sub-tidal lands; all lands below any identifiable debris line left by tidal action; all lands with vegetation present that is tolerant of salt water and occurs primarily in a salt water or estuarine habitat; and any swamp, marsh, bog, beach or contiguous lowland subject to tidal action during the maximum spring tide level as identified in tide tables published by the National Ocean Service. Coastal wetlands may include portions of coastal dunes.

Wetland, freshwater: Fresh water swamp, marsh, bog or similar area that is inundated or saturated by surface or ground water at a frequency and for a

duration sufficient to support, and normally does support, predominantly wetland vegetation.

Use this key starting at the first drainage class listed (very poorly drained). If the soil being evaluated does not exhibit the soil morphological feature for that drainage class, go to the next drainage class. Continue through each drainage class until the soil being evaluated meets the soil morphological features for a particular drainage class.

DRAINAGE CLASS	SOIL MORPHOLOGICAL FEATURES	COMMON SITE INDICATORS
VERY POORLY DRAINED	<p>1) Has organic soil material that extends from the surface¹ to a depth of 16" or more (Histosols)² or,</p> <p>2) Has Organic soil material that extends from the surface to a depth of 8 to 16 ". (Histic Epipedon)³ or,</p> <p>3) Has organic soil material that extends from the surface to a depth of 4 to 8" and the cambic horizon has a low Chroma matrix.⁴ or,</p> <p>4) Mineral soils with sulfidic materials within 20" of the mineral soil surface; Alluvial soils with and umbric epipedon. or,</p>	<p>Level or nearly level; occupies lowest position in the landscape. Commonly in depressions and is seasonally ponded.</p> <p>Common plant species include: rushes, cattails, sedges, sphagnum moss, tamarack, willow, black spruce, northern white cedar and red maple.</p>
POORLY DRAINED	<p>1) Has an albic horizon that has texture of loamy fine sand or coarser that lies just above an illuvial horizon having a texture of loamy fine sand or coarser, and has redoximorphic features in the albic horizon or in the upper part of an illuvial horizon that is less than 7" below the mineral soil surface. or,</p> <p>2) Has an Ap horizon that is 7" thick or greater with a value of less and chroma of 2 or less and a texture in all subhorizons within 20" of the mineral soil surface of loamy fine sand or coarser and have redoximorphic features directly beneath the Ap horizon. or,</p> <p>3) Has a low chroma matrix within 20" of the mineral soil surface and redoximorphic features that are less than 7 inches below the mineral soil surface. or,</p> <p>4) Has an Ap horizon that is 7" thick or greater with value of 3 or less and chroma of 2 or less and has a low chroma matrix within 20 inches of the mineral soil surface and has redoximorphic features or a low chroma matrix directly beneath the Ap horizon. or,</p>	<p>Level to gently sloping; side slopes, toe slopes, depressions and seepage areas.</p> <p>Common plant species include: sedges, alders, willow, red maple, gray birch and</p>

DRAINAGE CLASS	SOIL MORPHOLOGICAL FEATURES	COMMON SITE INDICATORS
SOMEWHAT POORLY DRAINED	1) Has redoximorphic features at a depth of 7" to less than 16" below the mineral soil surface. or,	Level to strongly sloping; long smooth side slopes, broad depressions and seepage areas. Common plant species include: red osier dogwood, alders, willow, spruce, balsam fir, red maple, elm, aspen, gray and yellow birch.
MODERATELY WELL DRAINED	2) Has redoximorphic features at a depth of 16" to less than below the mineral soil surface. or,	Level to steep; crests and upper part of long smooth slopes and broad terraces. Common plant species include: northern hardwoods, white and red pine, hemlock and grasses.
WELL DRAINED	Soil depth is at least 20 inches to bedrock and has a texture of Loamy very fine sand or finer and redoximorphic, if present, are greater than 40" below the mineral soil surface. ⁵ or,	Level to very steep; knolls, complex slopes and terraces. Common plant species include: Northern hardwoods, white and red pine, hemlock and grasses.
SOMEWHAT EXCESSIVELY DRAINED	1) Soil depth is 10 to 20" to bedrock and has a texture of loamy or loamy-skeletal particle-size class. 2) Soil depth is 20" or greater to bedrock with a sandy or sandy-skeletal particle-size class with a loamy cap 10" thick or greater.	Level to very steep; knolls, complex slopes and terraces. Common plant species include: northern hardwoods, white and red pine, white and red spruce, hemlock and grasses.
EXCESSIVELY DRAINED	1) Soil depth is less than 10" to bedrock 2) Sandy or sandy-skeletal particle-size class with a loamy cap less than 10" thick	Level to very steep; knolls, convex slopes and terraces Common plant species include: northern hardwoods, white and red pine, white and red spruce, hemlock and grasses. vegetation also includes shrubs, ferns, mosses and lichens.

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